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# INSTRUMENTS

## INDUSTRIAL — SCIENTIFIC

Devoted to the Instrument Problems of all Industries

Vol. 2. No. 1 Pittsburgh, Pa. January, 1929

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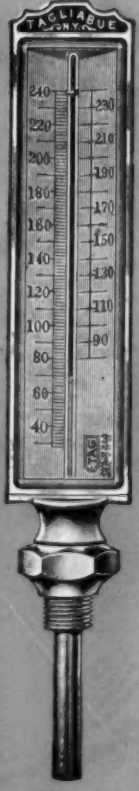

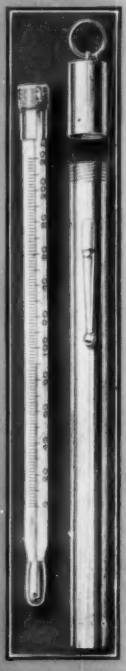

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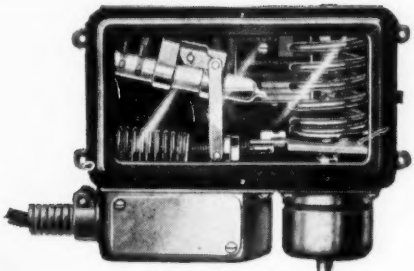

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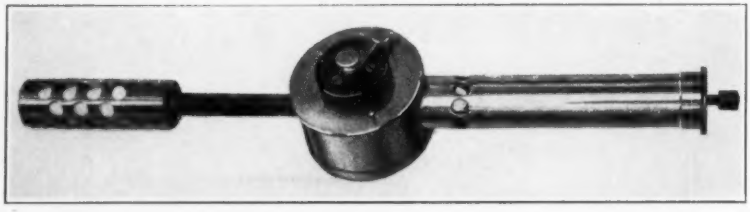

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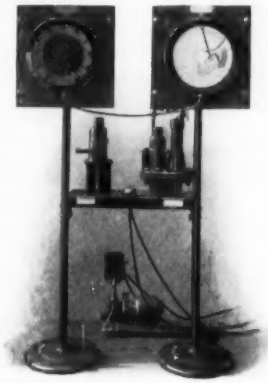

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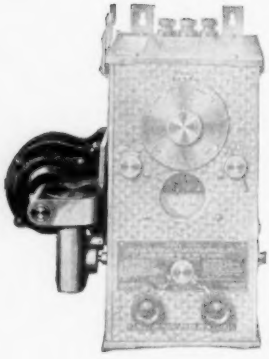

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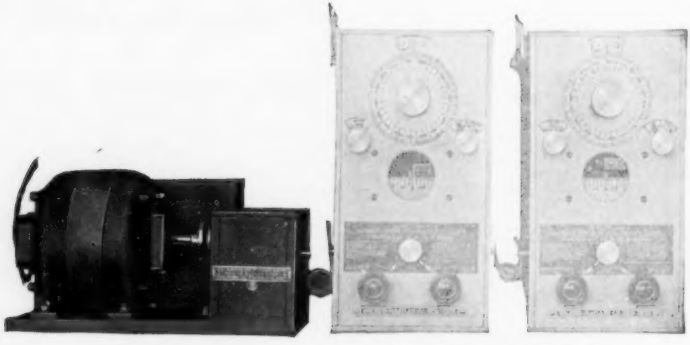

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## Instruments Birthday

ONE year old! This month INSTRUMENTS begins its second volume. In January 1928, it came forth as a medium for the dissemination of information on instruments and devices for measurement, inspection and control.

Its contributors and collaborators have done fine work and deserve full credit for the success the publication has enjoyed.

And now for a start on the new volume. With continued cooperation, INSTRUMENTS undoubtedly will prove of greater usefulness to its readers and a material aid to those who are looking for information on instruments and devices for measurement, inspection and control.

Readers are invited to send in their contributions and comments.

——— :: ———

## To Our Readers

IN his various trips the editor makes it a point to call on a number of men listed on our subscription list in order to receive an expression from them as to how closely INSTRUMENTS has adhered to the work it has set out to do.

The opinions expressed have been very favorable and show that INSTRUMENTS has filled a very important gap in the trade literature even though this is already voluminous. That the service performed by this periodical is desired by industry is evidenced by the daily growing list of subscribers.

The primary function of an instrument magazine is to present new and effective developments on instruments for use in industry and science and to give them to its readers in a thoroughly comprehensive manner. Given such a background the manufacturers, who supply the demand thus created, are enabled to better serve those readers.

The service offered by INSTRUMENTS is briefly reviewed on this our first anniversary:

1. The original articles written by specialists present information of considerable value. File cards covering the articles in each issue are furnished for filing.

2. The instrument companies in the New Instrument Section monthly present new developments made by them.

3. The Current Literature Review is a monthly digest of the information on instruments and devices for measurement, inspection and control. This information is arranged for mounting on index cards if desired. Photostat copies of any of the articles, as well as translations can be furnished to order.

4. INSTRUMENTS receives the official patent gazettes of the United States, England and Germany and lists all patents covering instruments and devices for measurement, inspection and control.

5. INSTRUMENTS is on the mailing lists of instrument manufacturers, this assures the receipt of all literature, bulletins, catalogues, etc. These are then listed in the Catalogue Library. Requests from readers for catalogues are sent to the manufacturers.

6. New books on measurement, inspection and instruments are reviewed in the INSTRUMENTS Book Shelf. The Book Shelf also will procure books and periodicals on order.

7. The Information Section is in a position to furnish information on sources of supply of instruments and devices for measurement, inspection and control from the collection of manufacturers literature. INSTRUMENTS brings together in one place the literature on instruments and devices for measurement, inspection and control. It meets the needs of those interested in this field. All the above services are placed at your disposal for $2.00 per year.

It has been our endeavor to extend this service to all who may derive benefit from it. The editor feels certain that each subscriber has two or three acquaintances who are looking for such a service; call this to their attention—for a "bigger and better" INSTRUMENTS during 1929.

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## Dr. Curtis Added to Instruments Collaborators

Dr. Heber D. Curtis, Director of the Allegheny Observatory, Pittsburgh, is the latest addition to our list of collaborators.

Dr. Curtis will leave shortly with the Swarthmore expedition for Sumatra to witness the eclipse of the sun.

——— :: ———

## Future Issues of Instruments

IN the December issue of INSTRUMENTS the editor announced a series of articles on the Measurement of Color by Dr. Albert Parsons Sachs, which will begin in the February issue.

The March issue will contain the first installment of an article by Francis M. Turner, Jr. entitled "Temperature Control in Process Industries."

## Integration of Diagrams

On page 482, November issue, formula (5) should read

$$= \frac{\sqrt{[(1-a)+b]\ [1+b]}}{\sqrt{(1-a)}+b}$$

———— :: ————

## Back Issues Not Available

REQUESTS are received daily for back issues of INSTRUMENTS and we are sorry that it is not possible for us to comply with these requests.

In answer to our appeals for the return of copies of these issues we have to-date received so few copies that there are still over three hundred requests we cannot fill.

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Time and money can be saved by reading Instruments' Advertising Pages as often as its editorial pages. That is because all advertising in INSTRUMENTS is vouched for by the company whose name is on the advertisement.

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# Recent Developments in the Field of Magnetic Measurements

*Thomas Spooner, East Pittsburgh, Pa.**

MAGNETIC testing naturally divides itself into three types as follows:

1. Methods of determining the magnetic properties of materials.
2. Magnetic analysis: namely, magnetic tests which, when properly interpreted, give an indication of other physical properties.
3. Magnetic surveying or prospecting: namely, the detection by magnetic means of the presence of ore bodies below the surface of the earth.

A number of advances have been made in the art of magnetic testing during the last two years which are worthy of notice. Under the first classification the following may be considered.

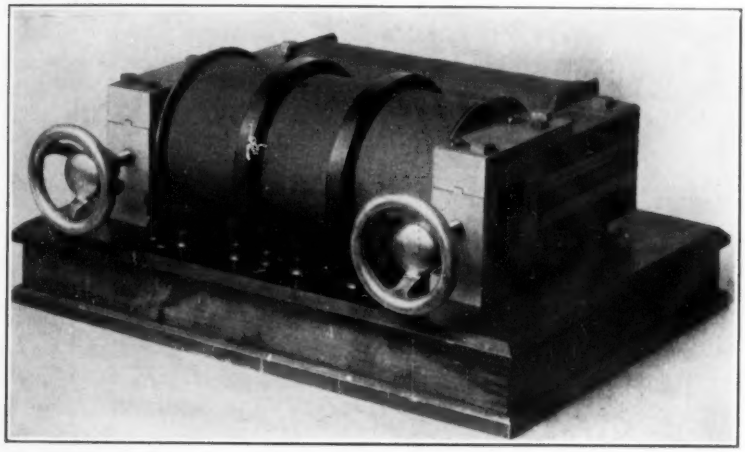

Fig. 1 "J" Permeameter.

## PART I
## MAGNETIC PROPERTY DETERMINATIONS

*The "J" Permeameter:*

The so-called "J" permeameter as developed by Mr. Babbitt of the Western Electric Company[1] seems to be a distinct advance in the art of magnetic testing. The permeameter consists of a "U" shaped yoke, the magnetic circuit being completed by the sample under test. Figure 1 shows the assembled instrument. The ordinary yoke type of perme-

*Research Department, Westinghouse Electric & Manufacturing Company.

[1]An Improved Permeameter for Testing Magnet Steel. B. J. Babbitt, Journal of the Optical Society of America & Review of Scientific Instruments, p. 47, July, 1928.

ameter has a magnetizing coil either on the yoke or on the sample. Each method has its disadvantages. If the magnetizing coil is on the yoke the flux distribution in the sample is far from uniform being higher at the ends and lowest in the middle. If, on the other hand, the coil is on the sample, the flux distribution is just the reverse. By using two coils, one on the yoke and one on the sample in series and properly proportioned, Mr. Babbitt has succeeded in obtaining practically uniform flux distribution over the central portion of the sample.

For the greatest simplicity in testing it is desirable that the magnetizing current shall be proportional to the magnetic force actually applied to the sample. In order that this shall be the case for the "J" type of permeameter it is essential that the yoke shall have a sensibly constant reluctance. There is no single ferro-magnetic material for whcih this is true over the desired range of magnetizing forces. Mr. Babbitt, however, has accomplished this result by using a combination of ordinary iron, permalloy, hipernik and silicon steel in the proper proportions. By placing an air coil with a large number of turns adjacent to the test specimen with its axis parallel, it has been shown that the magnetizing current is directly proportional to the "H" values of the sample to within the required limits of accuracy. It is, therefore, possible in this permeameter to determine "H" by reading the magnetizing current and applying a suitable constant. "B" is determined, of course, in the ordinary way by an exploring coil around the sample connected to a ballistic galvanometer.

This permeameter has a range of magnetizing forces up to 1000 gil./cm. In order to eliminate air corrections for the "B" exploring coil and in order to read intrinsic induction directly which is often desirable for high magnetizing forces an air coil is wound parallel and adjacent to the sample, so proportioned, that when connected in opposition to the B coil with no sample in the yoke, no deflection is produced in the ballistic galvanometer on reversing the magnetizing force. As a consequence when the sample is inserted B—H or the intrinsic, $B_1$ is read directly.

*New Picou Permeameter:*

The original Picou permeameter had two yokes each with a magnetizing winding and a single sample also supplied with a magnetizing winding[2]. The new Picou permeameter, as manufactured by the Societé des Ateliers, J. Carpentier, uses the same structure as the well-known double yoke Burrows instrument but is simpler in operation[3]. The operation is exactly the same as for the Burrows permeameter using a single specimen with a companion piece which should be somewhat similar in magnetic properties. No compensation is attempted between the two samples, the only compensation being that for uniformity along the length of the test sample. With this simplification the accuracy is

[2]Properties and Testing of Materials. Thos. Spooner, p. 233.
[3]Rev. Gen. de l' Electricité. Sept. 4, 1926.

slightly less than according to the original Burrows manipulation but is probably quite satisfactory for any but the most refined tests. So far as we know, this is the first European concern to adopt the Burrows principle in the construction of a permeameter.

*Hughes Cambridge Magnetic Bridge Permeameter:*

This instrument as manufactured by the Cambridge Instrument Company[4], England, depends for its action on the principle that when just sufficient magneto-motive-force is supplied to overcome the reluctance of a portion of a magnetic specimen there will be no difference in magnetic potential between the ends of this part of the sample. Figure 2 shows the diagram of connections for the apparatus. This permeameter consists of a "U" shaped yoke with the specimen completing the

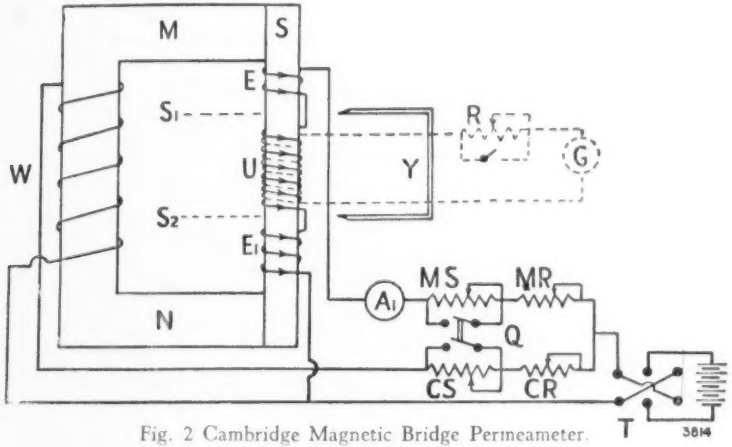


Fig. 2 Cambridge Magnetic Bridge Permeameter.

magnetic circuit as was the case with the "J" permeameter. The method of operation, however, is somewhat different. An exploring coil as shown by the dotted lines is connected to a ballistic galvanometer and the magnetic shunt "Y" is brought into contact with the specimen and suddenly released by a spring. If there is a difference of mmf. between the terminals of the shunt "Y" the ballistic galvanometer will deflect. By properly adjusting the compensating current "W" on the yoke, a condition can be obtained such that when "Y" is suddenly removed, no ballistic galvanometer deflection will result. When this adjustment is made the section "U" of the magnetizing winding on the sample supplies just sufficient mmf. to overcome the reluctance of the specimen over the length corresponding to the distance between the points of the magnetic shunt "Y." The magnetizing force may then be determined by the well-known formula $H = 0.4\pi NI$ where N is the number of turns per cm. length. B, of course, is determined ballistically in the usual

[4]Journal of Sci. Instruments, p. 357, August, 1927.

way. The turns are such that H = 100 I. In order that there shall be no error due to residual flux in Y this member can be rotated 180°.

*Fahy's Direct-Reading Permeameter:*

There is a considerable demand for a direct-reading permeameter for the testing of magnetic materials for inspection purposes and for magnetic analysis. In a recent number of Instruments[5] Mr. Fahy has described such a device which has just been developed by him. It is a semi-portable relatively inexpensive simple permeameter of novel design which is said to give fairly reliable results. While the absolute accuracy is probably not as great as for a few of the more complicated instruments, it is undoubtedly sufficiently good for many purposes, particularly in connection with magnetic analysis. The induction in the specimen is given by means of a direct-reading magnetic potentiometer connected across an air gap in the yoke which completes the magnetic circuit which contains the test specimen. The magneto-motive-force is obtained from the reading of an ammeter connected in series with the magnetizing winding which is somewhat shorter than and encloses the sample under test. The apparatus may be used with a.c. or d.c. Mr. Fahy's original article should be consulted for a detailed description of the apparatus.

*Gokhale's Saturation Permeameter:*

Mr. Gokhale has recently described an apparatus for obtaining saturation values directly[6]. Figure 3 gives a diagram of connections. This

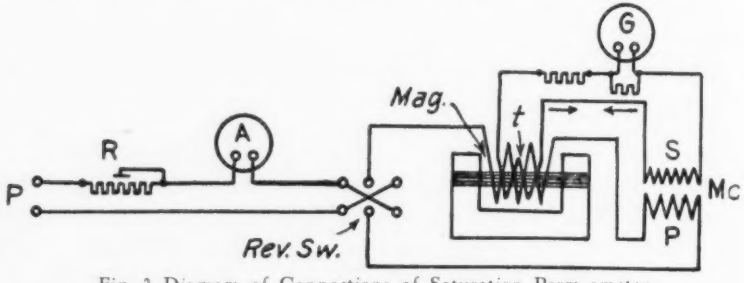


Fig. 3 Diagram of Connections of Saturation Permeameter.

again is a yoke type of instrument but with no compensation, since the inductions are so high that compensation is unnecessary. The magnetizing current passes through a coil containing very many turns surrounding the sample. In series with this coil is the primary of a variable mutual inductor. An exploring coil surrounding the sample is connected through a ballistic galvanometer and in series witih the secondary of the mutual inductor. When saturation is reached the intrinsic induction by definition ceases to increase. In the operation of this apparatus it is simply necessary to keep reversing the magnetizing current and

[5]Direct-Reading Permeameter—Frank Fahy, Instruments, p. 507, Dec. 1928.
[6]Saturation Permeater, S. L. Gokhale, A.I.E.E. Journal, p. 196, March, 1928.

adjusting the mutual inductor until for a number of magnetizing forces corresponding to inductions above the saturation value no change is produced in the reading of the ballistic galvanometer. This constant deflection of the galvanometer corresponds to the intrinsic induction for the specimen. A range of magnetizing forces from 4500 gil./cm. down to 200 may be used with reliable results.

*Kapitza's Intense Magnetic Fields:*

Kapitza[7] has described further advances in the generation of intense magnetic fields which while of no practical value at present are of enormous theoretical interest. In his latest experiments he makes use of a synchronous generator operating at 3500 rpm. and capable of developing 55,000 kw. on short circuit. This generator has no artificial cooling and is directly connected to a d.c. drive motor. It has, of course, very low impendence and is very strongly constructed. Automatic switching devices are supplied for closing the circuit at zero voltage and breaking at zero current. The timing arrangements must be very reliable because the switch must open with an accuracy of 0.0003 of a second. At the time of short circuit an oscillograph is automatically started in order to record the maximum value of the instantaneous current. One of the greatest difficulties was in the construction of a suitable coil which would withstand the mechanical stresses. Radial forces are the ones which had to be dealt with primarily. By proper dimensioning of the coils and using cadmium copper for strength, reinforced with steel bands, satisfactory coils were obtained. In addition to determining the field strength from the magnetizing current, a ballistic galvanometer and an exploring coil were cut in the circuit near the point of maximum current. Field strengths as high as 320,000 gausses for a volume of 2 cu. cm. have been obtained witth prospects of higher values later.

*Null Method of Determining Magnetic Field Intensity:*

In certain types of permeameters high sensitivity in the measurement of induction is obtained by simultaneously reversing the magneto-motive-force applied to the specimen and the primary current of a mutual inductance, the exploring coil on the specimen and the secondary of the mutual inductance being connected in opposition through a galvanometer or flux meter. Mr. Lane[8] has accomplished the same results for the measurement of magnetic fields by the mechanical rotation of an exploring coil through 180°. Figure 4 shows the apparatus diagramatically. The small search coil and the reversing commutator are connected together mechanically and caused to rotate 180° by means of a spring. The mechanical commutator reverses the current from the battery E through the primary of the mutual inductance M. The secondary of the mutual inductance is connected in series with the search coil and a

[7]Further Developments of the Method of Obtaining Strong Magnetic Fields. P. Kapitza, Proceedings of the Royal Soc. p. 658, Aug. 2, 1927.

[8]A Null Method for Determining Magnetic Field Intensity, C. T. Lane Journal of Sci. Instruments, p. 214, July, 1928.

resistance through the galvanometer G. Now, if the search coil is placed in a magnetic field and rotated 180° a voltage will be generated which will cause the galvanometer to deflect. At the same time if the connections are correct the primary current of the mutual inductance M is also reversed and induced voltage in the secondary coil tends to cause the galvanometer to deflect in the opposite direction. If the primary current of the mutual inductance is properly adjusted there will be no

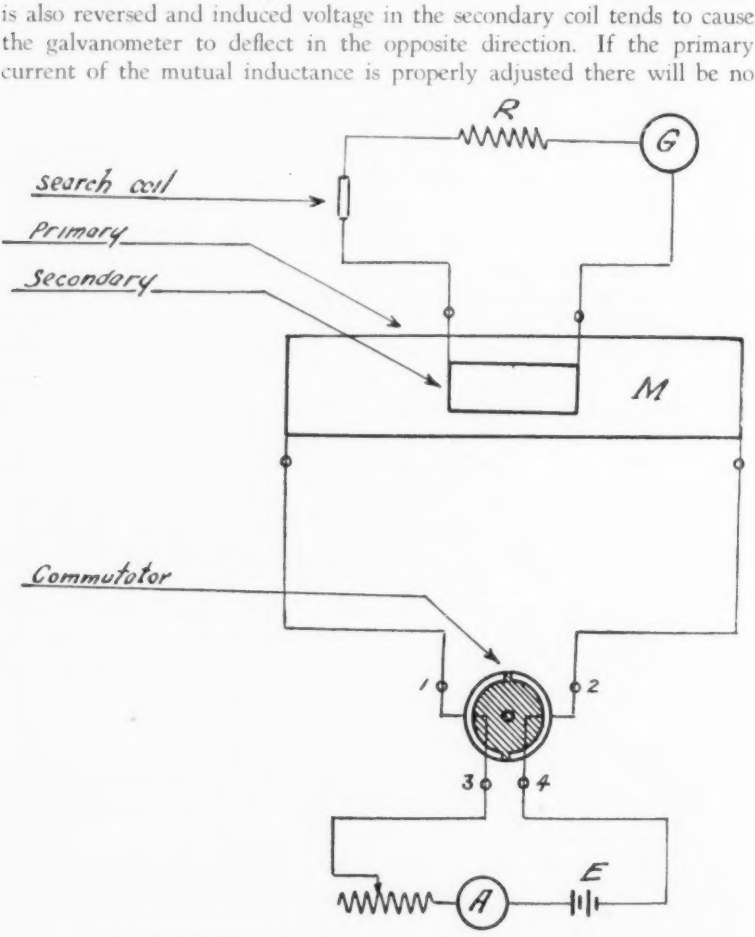


Fig. 4 Null Method for Determining Magnetic Field Intensity.

residual galvanometer deflection and the amount of flux threading the search coil, in other words the strength of the magnetic field, may be determined from the current passing through the primary of M and its mutual inductance value.

This gives a simple sensitive null method for determining field strengths and should be useful in connection with the exploration of

[9]Convenient Forms of Magnetometers—S. R. Williams, W. J. Eckert—Journal of the Optical Soc. of America & Rev. Sci. Instruments, page 203, March, 1928.

machine air-gap fields and the like, where a small coil only can be used and a large number of determinations are required.

*Magnetometers:*

The simple rugged types of magnetometers have recently been described by Williams and Eckert[9], which are suitable where fairly large field strengths are available and high sensitivity is not required. The essential feature of these magnetometers is the use of a bell-shape magnet slotted along the vertical axis. A suitable suspension and mirror are used and the bell-shaped magnet is immersed in damping oil. The usual optical system may be used, whereby the angular movement of the spot of light is double the movement of the magnetometer or if desired, by the use of a 45° mirror and vertical illumination, the magnet and beam of light will have the same angular deflection. By using two magnetic elements, an astatic arrangement may be used. If greater sensitivity is required, it might be possible to use some of the new high cobalt magnet

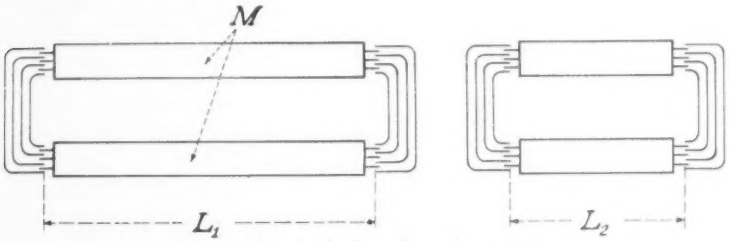


Fig. 5 Churcher's Core Loss Apparatus.

materials. These magnetometers will be referred to later in the second section.

*Churcher's Core Loss Tester:*

Commercial tests for core losses of sheet steel in this country are usually made by the well known Epstein method[10], though at the Bureau of Standards, tests are also sometimes made by the Lloyd method[11].

In the Epstein method four bundles of strips 3 x 50 cms. are arranged in a hollow square with a primary and secondary winding surrounding each bundle. This requires a considerable number of strips for a 5 or 10 kg. sample and there are certain inaccuracies due to shearing strains and leakage fluxes. The Lloyd apparatus uses wider strips thus minimizing the shearing strain effects. The number of strips are less and are stood on edge forming a hollow square with corner pieces provided to complete the magnetic circuit. Churcher[12] of the Metropolitan-Vickers Company, England, has modified the Lloyd method so that fewer strips are required and the assembly is simpler. Figure 5 shows the essentials of the arrangement. The strips are 4" x 29¼" and are 16 in number.

[10]A.S.T.M. Standards, 1927, p. 358, Part 1.
[11]The Testing of Transformer Steel, M. G. Lloyd and J. S. Fisher, Bureau of Standards, Sci. Paper 109.
[12]Testing Magnetic Sheet Steel, B. G. Churcher, World Power, p. 15, January, 1928.

The corner pieces are U-shaped and the loss in them is determined by testing a sample with an effective length $L_1$ and then cutting it off to an effective length of $L_2 = L_1/2$ and retesting. From these two results the loss in the yokes can readily be calculated. Since the two halves of the sample are so close together, precautions have to be taken to reduce the leakage flux. This is accomplished by dividing the magnetizing winding into ten equal and parallel sections per leg. If the windings are reasonably close to the sample there is practically uniform flux throughout the length of the sample, since, assuming negligible resistance in the copper, the counter emf must be the same in each coil. If the sample varies from the normal weight the total flux in the U pieces will be different for a given flux density in the sample. The losses in the yokes are corrected by means of suitable curves prepared for the purpose. This apparatus may also be used for the approximate determination of the exciting current, the errors probably being less at the higher inductions. An accuracy of 1% for loss measurements and 4% for exciting currents is claimed.

(*Continued in February Issue*)

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To help you find any instrument easily and quickly, refer to the Buyers' Guide contained in the back of this book. Turn to it now and see how wide the variety of instruments it offers. Remember to consult the Instruments' Buyers' Guide when in the market for instruments.

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## THE BROWN INSTRUMENT COMPANY MOVES NEW YORK OFFICE

On and after Wednesday, December 19th, the New York Office of The Brown Instrument Company will be located at Room 1502 Roebling Building, 117 Liberty Street, New York City, removing from 50 Church Street.

This change was made necessary by the need of larger quarters to provide for the increased staff now attached to this district office. The popularity of the Brown Electric Flow Meter and growing demand for other Brown Instruments for measuring, recording and controlling temperature, pressure, liquid level $\%CO_2$ and other industrial process factors is shown in the rapid increase of business received from the New York area.

It is believed that this increase in the Brown Instrument Company staff, together with the better facilities afforded by a larger office will be of material benefit to the company's customers in this territory.

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The Federal Products Corporation have moved into their new plant at 1144 Eddy Street, Providence, R. I. This is the third expansion in seven years.

# Electrical Instrument Developments During 1927-8

*E. S. Lincoln, New York, N. Y.**

THE past two years have not brought out any radical departures in the development of electrical measuring instruments, but many improvements have been made in all classes of instruments, the tendency being to decrease their size and increase their accuracy. These same refinements have been going on for a number of years until today the electrical industry has a large variety of instruments to cover all of its requirements.

Great strides have been made in the development of instruments using electricity as a means for measurements but not for the measurements of electrical quantities. At no time in the history of instrument development has there been a better understanding of the great value electrical measuring instruments are to industry as a whole.

Watthour meters have been given particular attention, and their accuracy at light loads and heavy overloads has been increased. They are less affected by temperature changes than the earlier forms.

Development of instruments for radio use has greatly increased, and many testing sets are now available. The Hoyt Radio tube tester is fully described on page 247 of the May issue of *Instruments*. Similar outfits have been placed on the market by other manufacturers.

A few years ago the oscillograph was considered somewhat of a laboratory instrument, but today it is in common use and has undergone many needed improvements. In Figures 1 and 2 are shown one of the latest oscillographs, manufactured by the Westinghouse Electric and Mfg. Co.

Multiple-element oscillographs are well-suited for power investigations. For simultaneous records a 6-element instrument was developed, and then, later, one containing 9 elements was placed on the market. The compactness of this oscillograph makes it well adapted for portable use. In fact, the present oscillographs, with 9 galvanometers, are much smaller than the first commercial, 3-element, portable oscillographs.

A string oscillograph has also been placed on the market by the General Radio Company. This instrument is described in detail on Page 491 of the November issue of "Instruments."

Space does not permit a detailed description of the oscillograph switchboard instruments, which have reached a high state of perfection.

The Roller-Smith Company have put on the market a very compact switchboard ammeter for 3-phase circuits. (See New Instrument Section in this issue.) This Company has also placed on the market a very convenient circuit tester, shown in Figure 3. This instrument is very compact and is recommended for use in preference to magnetos

*Consulting Engineer.

and A.C. bell-ringing devices because of its accuracy of indication under all conditions. It is used for determining whether or not electrical circuit exists between two conductors and, also, to read the resistances of a circuit under test. Indications on this circuit tester are not misleading, as is often the case with magnetos, which will cause a bell to ring when the circuits include a condenser. Inductance and capacity have no effect on the readings. It is a handy instrument for the repair men and wire men, and where work calls for identification and checking up of circuits.

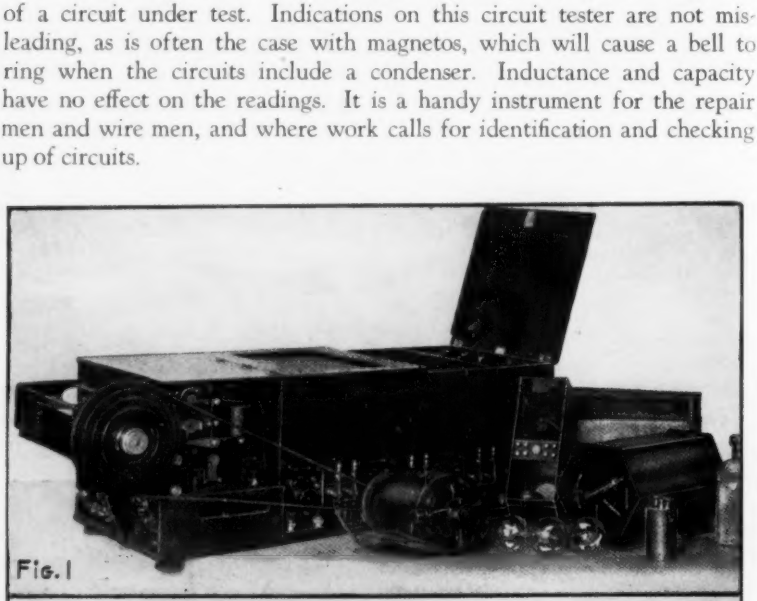


Fig. 1

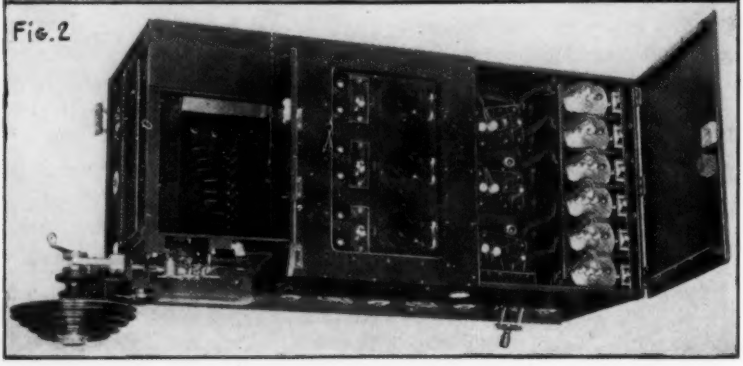


Fig. 2

This Company has also placed on the market a rail bond tester, using only one dry cell for its operation.

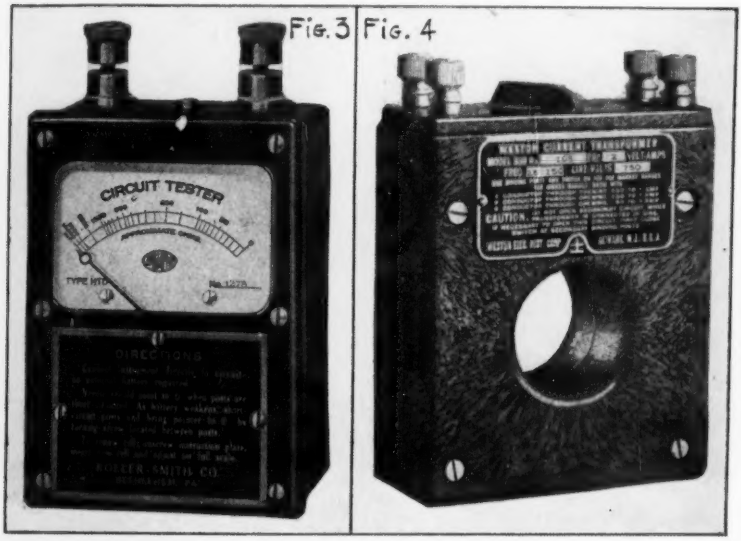
A very sensitive switchboard type frequency meter has been developed by the General Electric Company. This instrument is so sensitive that its entire scale shows a variation of one cycle in the frequency of the circuit. This frequency meter was described in detail in the October issue of "Instruments," page 450. It is also made with less sensitive scales, where variations of as high as 5 cycles above and below normal are indicated.

This Company has also developed a new line of strip-chart recording instruments for use on both direct and alternating current. These instruments are illustrated and described in the November issue of Instruments on page 486.

A complete line of round-type switchboard instruments has also been placed upon the market by the General Electric Company, making it possible to equip switchboards with instruments that match in design for both alternating current and direct current.

During the past few years, the use of 4-wire, 3-phase systems has greatly increased, and for this reason the Esterline-Angus Company has developed a graphic watt meter for use on this type of circuit.

In testing current transformers, it has often been difficult to find a simple method of adjusting the burden of reproducing working condi-




tions. In Figure 5 is shown an adjustable burden for current transformer testing, manufactured by the Leeds & Northrup Company. By means of this adjustable burden, all conditions of testing can be reproduced within reasonable limits. These burdens have a normal rating of 50 volt-amperes at 5 amperes on a 60 cycle circuit, using either all resistance or all inductance.

This same Company has also developed a portable insulation testing set, having a range from .1 megohm to 1000 megohms. The instrument is complete, requiring no external source of potential, and the scale reads directly in megohms. When the unknown resistance is connected to the binding post, its value is shown immediately on the scale, no further adjustments being required. Thus, the operator has both hands free for making connections, etc. Furthermore, the operator need not

be right at the instrument when making measurements but only near enough to read the scale, which can be seen at a considerable distance. This test set is furnished with two scales, one reading from—0.1 to 10 megohms, and the other from 10 to 1,000 megohms.

This Company has also developed a frequency controller, designed, principally, for use in generating stations to regulate the speed of their generators. This controller regulates the generator speed by operating a synchronizing motor in the governor of the turbine.

In Figure 6 is shown a "limit bridge," also developed by the Leeds & Northrup Company, for the rapid checking of resistance units. These bridges are used for checking large quantities of coils or resistance units

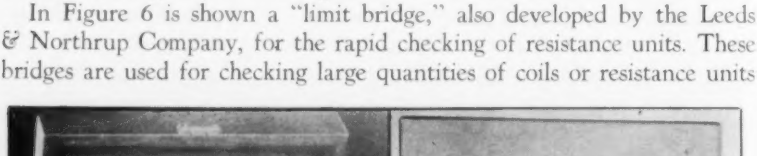


Fig. 5 Fig. 6

against any desired standard. It is shown at a glance whether or not the unknown resistance is sufficiently close in value to the standard.

There have been some interesting developments in Ohmmeters, brought out by James G. Biddle. Type CR and Type IR "Megger" Ohmmeters can be used in either a horizontal or vertical position. Type CR instruments are made in low ranges for the measurement of conductor resistance and are supplied in various ranges from 0—0.1 to 0—10,000 ohms. Most of the ranges can be supplied with switches to divide scale readings by 10 or by 10 and 100. The operating voltages vary from 2 to 30 volts. Type IR instruments are made in high ranges for the measurement of insulation resistance and are supplied in various ranges from 0—0.1 megohm to 0—100 megohms. The operating voltages vary from 3 to 1000 volts. Both Type CR and Type IR "Megger" Ohmmeters operate on the true ohmmeter principle, in which the exact voltage applied does not affect the accuracy of the reading. To use

either type of instrument, it is necessary only to connect the potential binding posts to a direct current source of potential of approximately the proper value. The resistance under test is connected to the "X" binding posts, and the resistance read directly on the scale.

This Company has also put out "Megger" Ground Resistance Testers, which are provided with a self-contained, hand-driven generator, supplying direct current. For detailed information on this instrument, see article "Ground Testing" by T. B. Whitson in the July issue of *Instruments*.

A very compact Ground-Ohmer has been placed upon the market by Herman H. Sticht & Company. The resistance is obtained by making one adjustment of a slide wire. The galvanometer gives a positive deflection to the right or to the left and indicates the direction of unbalance. Measurements made by this instrument are not influenced by the resistances of the probe and auxiliary ground. These influence the sensitivity but not the accuracy.

The Bristol Company of Waterbury, Conn., have developed a very compact recording ammeter, having three scales and three independent pens, for use on 3-phase circuits. These ammeters have overlapping charts and are all contained in a rectangular case, approximately 14"x8".

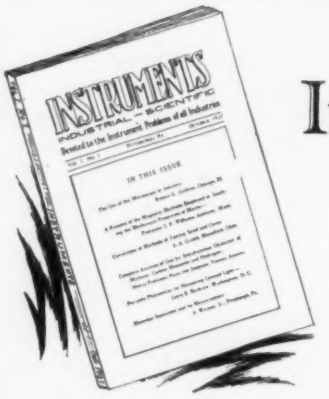
Considerable attention to the development of radio instruments has been given by the Weston Electrical Instrument Company. Not only instruments but complete testing sets for use in radio have been placde upon the market by this concern.

Improvements have been made in the electrical speed indicators manufactured by this Company, special attention have been given to its application for railroad work.

A selective A.C. ammeter has also been developed by this Company and is used in measurements of alternating current circuits where direct current is also present, as in train control, track circuits, or wherever an A.C. ammeter of unusually low impendance is required. Its alternating current readings are not appreciably affected by the presence of a direct current component of three to five times the full scale value at any range. These ammeters are made in capacities up to 10 ammeters.

This same Company has also developed a number of small instruments of the Thermo-Couple type and also of the movable iron type and permanent magnet moving coil principle, these completing its already wide range of instrument for meeting all conditions of measurements.

In Figure 4 is shown a Model 539 miniature portable current transformer, having a range of from 2 to 20 amperes, self-contained, and a maximum of 200 amperes with an inserted primary. The secondary of this transformer has a capacity of 2 volt amperes, and its full load current is 1 ampere. It is designed for use with their Model 528 ammeters, having a 1 ampere range. These transformers weigh only 2 5/8 lbs., and they are very compact, which should make them very convenient for all kinds of testing where an accuracy of 1 per cent is sufficient.




# Instruments' Service

THE manager of a large southern wall board mill had a control problem. In 15 seconds he wanted to make the following tests: thickness, weight and cross bending strength. He asked the editor of INSTRUMENTS where he could obtain information on instruments and devices to do this.

The engineer in charge of the construction of a large city sewerage disposal plant desired information as to the manufacturers of gauges which would indicate the liquid level in six large tanks, and he asked the editor of INSTRUMENTS for the information.

The research director of a company building boilers desired information on high pressure flow-meters—he asked the editor of INSTRUMENTS.

The chief engineer of a large oil company wanted information on engine indicators—a terra cotta company desired information on hydrometers—a large public utility on steam meters—an electrical engineer on oscillographs—a paper company on a bending tester—a glass company on instruments for measuring roll temperatures—a large automobile axle company on tachometers—a ship building company on engine indicators—a heating engineer on water meters—a machine shop on dial gauges—a celluloid company on machine shop gauges—a combustion engineer on continuous steam colorimeters—etc. All asked the editor of INSTRUMENTS.

Does this not show that INSTRUMENTS is the national publication for all persons interested in instruments and devices for measurement, inspection and control—the logical publication in which to place the advertising of companies who manufacture such products?

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# Aircraft Instrument Developments in 1928

*Bradley Jones, Dayton, Ohio**

IN any engineering development it is rarely the case that some new physical principle is discovered and immediately put to practical application. The expansion of gases on heating, was known long before the first steam engine was built; electro-magnetism was known previous to the first electric telegraph. So with aircraft instruments no new principles have been discovered, and put to use in practical working devices immediately.

It is because engineering is a practical art that development is slow. Hasty judgments have no place in development work. Each step must be tested before further progress is made. Even when an instrument is put in practical use there is always a possibility of improvement. To the instrument engineer there is no such thing as a satisfactory instrument, for if he is a true engineer—he is not satisfied.

There is always a question as to what status an object must occupy before it may be properly termed developed. One research agency rushes into publicity heralding a new device while it is still a nebulous fancy in the mind of the inventor, while another laboratory hesitates to announce a development after months of service use for fear that further use may show up weak points.

In the field of aeronautic instruments, progress has been in general on conservative lines. The familiar standard equipment has been improved by cleaning up the design, making alterations here and there, all tending to better the performance. The appearance has been given consideration and some may be classed as attractive in design.

Much thought has been given during the past year to the size of the instrument as regards the space occupied on the instrument board. At the close of the war, there were usually not more than seven instruments on the board. At that time the good old Liberty engine was the standard power-plant and the width of the airplane and consequently the width of the cockpit was determined by the width of the engine. Nowadays with narrower engines, the pockpit is barely wide enough for the average pilot's shoulders and is no longer fixed by the engine size. In addition, aviators now deem eleven or twelve instruments necessary for safe flying.

The decreasing size of instrument boards with the increasing number of instruments to be mounted on the boards has presented a problem. Several years ago the Army Air Corps initiated the development of vertical scale instruments for at that time it was not possible to crowd

*Engineering Division, War Department Air Service.
Published by permission of the Chief of the Air Corps, War Department, Washington, D. C.

the mechanisms of tachometers, altimeters and airspeed indicators into smaller round dial cases. At that time, vertical-dial instruments appeared to be the only solution for compact mounting of instruments.

During the past year, instrument engineers have been able to redesign the mechanisms of the most instruments so that they can be placed in smaller cases without sacrificing accuracy, precision or reliability. An instrument board equipped with these small-dial instruments is neat and attractive and adds greatly to the appearance of the cockpit. For fair-weather flying the newer instruments are quite satisfactory.

No one can do much flying without at some time encountering fog or clouds. Landing is not always feasible. Circumstances may make it necessary to fly through the clouds. If the aircraft has sufficient altitude to be sure of clearing all the mountains or other obstacles in its path, the aviator can depend on his instruments to fly level and straight, hoping that his destination will be fog-free. It is when one must come down through the "soup" that trouble lies.

When one cannot see beyond the propellor or easily make out his own wing tips is a time of dread. Every second one is expecting the crash to come or at least to have tree-tops tear through the wings. Keyed up to supernormal tension, one strains his eyes to penetrate the mist. Then it is that only a hurried glance is given to the instruments and again the head is over the side trying to pierce the fog.

Possibly the future will produce means of safely descending through fog but at present the pilot is going to depend on his eyesight when nearing the ground. This means that little time can be devoted to studying instruments. At such times, prettiness means nothing to the flyer. He wants something he can read in a hurry. On several occasions in the past, the writer has had ticklish experiences in fog so he admits he is prejudiced towards "bigger and better" instruments.

The mention of fog-flying naturally brings up the matter of instrumental aids. The radio-beacon is purely a radio proposition and would not come under the classification of instruments. A new altimeter is on the borderline, utilizing some of the principles of radio to give instrumental indications.

The instrument referred to is the "capacity" altimeter, which is superior to the aneroid types in that it is intended to give actual height above the ground rather than above sea level. Its operation depends on the mutual electric capacity between plates on the airplane and the ground. While research has been carried on at Wright Field for several years with discouraging results it now appears that success is in sight.

The old army compasses of the B-1 or B-3 types which have been so popular with commercial flyers have been cleaned up in design. No less than four different companies are producing their own designs of

airplane compasses which are neater and more compact while possessing the reliability of the older type.

Several gasoline gages have been produced experimentally. One of the distant-reading type which utilizes the pressure of the gasoline to change the resistance of an electric circuit, is very promising indeed.

Utilizing the usual aneroid, one company is using a different mechanism to transfer the motion of the aneroid to the pointer of their altimeter. This results in an instrument whose lag is very low. This departure from the conventional is very commendable.

Research is being conducted on altimeters to be used solely for landing with a range of 0 to 5000 feet. The scale is to be very open, so that it is hoped that an accuracy of 10 feet may be obtained close to the ground. By having a barometric scale on the altimeter it is hoped that landings made be made safely even in a dense fog.

The big feature of 1928 has been the reduction in size of the instruments. The author does not believe this an unmixed blessing, as in fog or at night ease of reading the instruments may mean the difference between safety and disaster.

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It is common experience that next to possessing information the ideal consideration is to know where to find it. This is especially true at present when the vast amount of information probably available on almost any subject is so great as to lie beyond the capacity of an individual. The problem usually is to know where to find what is wanted.

The world-wide demand for information of all kinds has grown so rapidly that one is often at his wit's end to know where to look for it.

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# Developments in Temperature Indicating, Recording and Control Instruments during 1928

*D. L. Mathias**

AS we look back over the developments in temperature indicating, recording and control instruments brought out during the past year, there is nothing that can be regarded as outstanding, but merely refinements to existing equipment, most of which have been described in the "New Instruments" section of previous issues of this publication.

Among the developments not covered in INSTRUMENTS during 1928 is an electric heat controller manufactured by Automatic Temperature Control Company. Essentially, this controller is a time cycle wattage input regulator and consists of a small synchronous motor which drives a cam at 1 RPM or other desired speed. This cam makes electrical contacts for a given percentage of its cycle, depending upon the setting of the manually adjustable knob extending from the controller case. This knob or dial is similar to a radio dial and shows on a graduated scale the percentage of cam cycle contact being made to the heating device. The setting of the wattage input to such a device can be so regulated as to hold any desired temperature within the capacity of the circuit. A small relay capable of handling 15 amperes at 110 volts is mounted in the same housing, the base of which is drilled and threaded for conduit.

This controller is being developed to operate from pyrometer contacts which will shift the setting between adjustable limits—the demand point similar to the adjustment now obtainable with fuel valves on industrial furnaces.

A small size temperature recorder was put out by the Bristol Company during 1928. The chart is four inches in diameter and records are continuous for a period of 72 hours, during which time the instrument requires no attention whatsoever. The measuring element consists of a bi-metallic helix which is positive in operation and extremely sensitive to temperature changes. This instrument is particularly suitable for securing an efficient check of atmospheric temperature in cold storage rooms, electrical refrigerating units, dairies, greenhouses, dwelling houses, hospitals, schools, hotels and theaters.

An improved type of switch, suitable for use with any make of pyrometer, has been added to the line of Claud S. Gordon Company. The blades are made from heavy phosphor bronze, heavily nickel plated, and are studded with pure platinum contacts which resist corrosion. As contacts are made between a point and a flat surface by a scratching action, it is claimed the contacts do not require cleaning as do those of other types. This company also markets a thermo couple tube which they claim

*Engineering Editor, INSTRUMENTS.

is the only tube that offers satisfactory protection against hot cyanide.

Leeds & Northrup Company has brought out two new instruments that will be of interest to those concerned with the indication, recording or controlling of temperatures. One of these instruments is the Semi-Precision Thermometer Bridge, fundamentally a double slidewire Wheatstone bridge. The range in resistance is 0—200 ohms, and is claimed to be accurate within 1/20 of one percent above 10 ohms. The other instrument is an Indicating Controller, an adaptation of their potentiometer pyrometer. It is intended for use in all places where accurate temperature measurement and control are required without an automatic record.

With the idea of making mercury filled thermometers easier to read, A. E. Moeller Company has developed a thermometer glass that possesses several unique features. Back of a wide mercury column is a bright red glass member, several times the width of the mercury column and extending the entire length of the scale. Completely surrounding the red glass member, except for the opening formed by the bore or capillary, is an opaque shield. As only that part of the red member above the mercury is visible, the top of the column is sharply defined and the temperature is easily read. The glass is moulded, which the makers claim assures accurate control of the size and position of the various parts of the complete tubing.

The principle development made by the Thwing Instrument Company, was along the lines of improving their radiation pyrometer. The receiving tube of this instrument contains all the latest developments in the design of radiation tubes. The front section contains a series of calibrated diaphragms and the back section of the tube, which is totally enclosed, contains a lens to intensify the heat and light rays. The back section also contains a conical mirror to concentrate radiant rays on the multiple thermocouple and a concave mirror to reflect the rays on to the thermocouple. This design of radiation receiving tube produces a comparatively high EMF.

During the past year, a number of developments were described in the "New Instruments" section, and will only be briefly mentioned in this review. American Schaeffer & Budenberg Corporation brought out a new precision controller, as described on page 289 of the June issue. The controller is of the vapor tension actuated, self-operated type, with a comparatively small but powerful diaphragm motor. The essential features are a rugged diaphragm, which, for a working pressure of 50 lbs. maximum, has an ultimate pressure limit of about 300 lbs. per square inch. A safety feature, consisting of a spring under initial tension inserted between bellows, allows further expansion of the bellows after the disc is forced against the valve seat. The liquid filling is so proportioned that a slight additional expansion will draw all liquid out of the bulb, and further temperature increase will raise the pressure only a negligible amount.

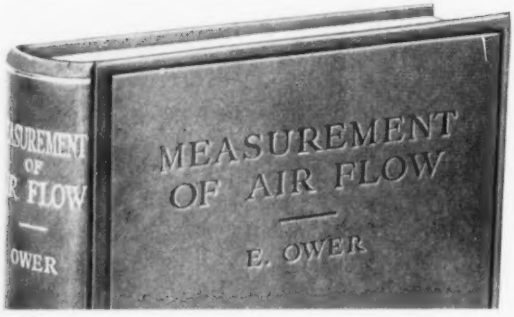
A new combination recording and controlling instrument manufactured by the Bristol Company is described on page 243 of the May issue. This instrument combines a round-chart instrument with a contacting controller. Each of these is actuated by a Bourdon tube in the form of a belical spring. The two pressure elements, while entirely separate and independent in operation, are identical in structure and connected through a common capillary tube to a single sensitive bulb.

The Duo Stat, manufactured by F. I. Raymond Company, and fully described on page 297 of the June issue, is of the well known distance type thermometer, but provided with two bulbs connected to the hollow spring instead of one. The needle thus indicates the sum of the temperatures of the two bulbs. In operation one bulb is placed in a convenient outdoor location, the other in the boiler or riser of the heating system. Based on the observation that in ordinary hot water heating systems, proper boiler limits are 170° in zero weather and 110° in 60° weather with proportional intermediate limits, the Duo Stat regulates the temperature of the water relative to the outdoor temperature by means of high and low contacts.

A steam operated controller, developed by C. J. Tagliabue Manufacturing Company and described in the February issue, page 119 utilizes a portion of the steam which heats an apparatus to obtain enough power, by means of a differential pressure above and below a diaphragm, to operate a valve governing the flow of steam. Variations in steam pressure do not affect the accuracy of control due to the use of the differential principle. The controller is designed to operate on pressures between 5 and 100 lbs. and for use as a temperature controller has a 40° range between the limits of 95° and 290° F. Adjustment of the setting point within the range of the controller is made by means of a knurled dial at the top of the controller head.

Another development of this company is a portable recording thermometer especially designed for use by automatic refrigerator manufacturers. The thermometer was described on page 197 of the April issue. With the exception of the sensitive bulb, all mechanical parts are enclosed in a moisture-proof case which, the maker claims protects the mechanism from moisture or other injurious atmospheric conditions. The location of the bulb on the outside of the case secures an immediate and accurate response to temperature changes. The recorder is of the mercury type, generally recognized as the most accurate and rugged for low temperature work.

This company also developed a new recording thermometer for milk plants. The proper pasteurization of milk demands that it be held at exact temperatures. The Tagliabue Company solved this problem by devising a special mechanism for their standard recording thermometer, whereby the motion of the pen arm is stepped-up in the important ranges and cut-down outside of these ranges. This instrument is described on page 526 of the December issue.




# The Measurement of Air Flow

By

E. OWER, B.SC. (LOND.), HONS. I., A.C.G.I.

*Bramwell Medallist; Member of the Institute of Heating and Ventilating Engineers; Assistant in the Aerodynamics Department, National Physical Laboratory.*

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# Searching for Information on Instruments & Measurements

*Richard Rimbach and M. Berg Rimbach**

IT is very often necessary to find information on instruments, tests, inspection, methods of using certain instruments, availability and practicability of certain instruments and devices, construction of instruments for patent information and other purposes, etc.

In the first place, in order that one may be thoroughly equipped to carry out an investigation of the literature, it is necessary that one have a reading knowledge of German. (A very good technical dictionary, the Illustrierte Woerterbuecher is edited by Alfred Schlomann, 16 volumes. A brief dictionary which also can be used to advantage is the Dictionaire Anglais-Francais-Allemand by R. Cornubert. Other dictionaries, which will be found useful are Physikalisches Handwoerterbuch by A. Berliner and K. Scheel and A German-English Dictionary for Chemists by A M. Patterson.)

The manner of conducting the search will vary slightly, depending upon the kind of information desired. In general the first procedure is to go through the books in List 1:

LIST 1—HANDBOOKS

Ferry—A Handbook of Physics Measurements.
Glazebrook—Dictionary of Applied Physics. 5 vols.
Berliner—Lehrbuch der Physik in Elementarer Darstellung.
Gehlhoft—Lehrbuch der Technischen Physik. 2 vols.
Geiger & Scheel—Handbuch der Physik. 24 vols.
Kohlrausch—Lehrbuch der Praktischen Physik.
Wien & Harms—Handbuch der Experimental Physik.

If more detailed information is desired it may be necessary to search for it in the books in List 2. This list is arranged alphabetically by author's names. This method was chosen as in many cases the books treat of several instruments or measurements and it would therefore not be possible to classify them under a subject heading.

LIST 2—BOOKS—*English*

Abbott—Testing Machines: Their History, Construction and Use.
Abraham—Surveying Instruments; Their Design, Construction, Testing and Adjustment.
Ainsworth—Manual for Engineers and Surveyors.
Allen—Principles and Practice of Electrical Testing as Applied to Apparatus, Circuits and Machines.
Amdursky—Handbook of the Petroleum Industry.
American Gas Institute—Gas Chemists Handbook.
American Institute of Electrical Engineers—Standards of the American Institute of Electrical Engineers.
Amer. Inst. Min. & Met. Engrs.—Symposium on Pyrometry.
Amer. Soc. Mech. Engrs.—Fluid Meters; Their Theory and Application, Part I.
Andrews—Ceramic Tests and Calculations.
Anthony—Lecture Notes on Theory of Electrical Measurements.
Archer—Commercial Electrical Measuring Instruments.
Baker—Thick Lens Optics.
Baker—Leveling: Barometric Trignometric and Spirit.
Baker—The Spectroscope and its Uses in General Analytical Chemistry.
Baly—Spectroscopy, 3 Vols.
Barnard & Welch—Practical Photo-Micrography.
Batson & Hyde—A Treatise on Mechanical Testing, 2 Vols.
Batson & Hyde—The Testing of Non-Ferrous Metals and Alloys.

*Editor and Associate Editor of INSTRUMENTS, respectively.

Barrett & Besterman—The Divining Rod.
Barrows—Light, Photometry and Illumination Engineering.
Barton & Doane—Sampling and Testing of Highway Materials.
Bausch—Use and Care of the Microscope.
Bausch & Lomb Optical Co.—Metro Manual; a Handbook for engineers, containing technical information regarding construction, adjustment and use of Transits, Tachymeters, Theodolites, Alidades and Levels.
Beale—How to work with the Microscope.
Bell—The Telescope.
Beck—The Microscope. A Simple Handbook.
Beck—The Microscope. An Advanced Handbook.
Benet—Electro-Ballastic Machines and the Schultz Chronoscope.
Berger & Sons—Handbook and Catalog: Engineering, Surveying and Mining Instruments.
Bohle—Electrical Photometry and Illumination.
Bolton—Electrical Measuring Instruments and Supply Meters.
Bolton—Evolution of the Thermometer (1592-1743)
Bolton—Time Measurement, An Introduction to Means and Ways of Reckoning Physical and Civil Time.
Booth—Clock and Watchmakers' Manual(1882)
Brainard—The Sextant, and other Reflecting Mathematical Instruments.
Breed & Hosmer—Principles and Practice of Surveying, 2 Vols.
British Ass. Advancement Science—Experiments for Improving the Construction of Practical Standards for Electrical Measurements.
British Engg. Stds. Ass.—British Standard Glossary of Terms used in Illumination and Photometry.
British Engg. Stds. Ass.—British Standard Specification for Recording Ammeters, Voltmeters and Wattmeters.
British Opt. Inst. Mfrs. Ass.—Dictionary of British Scientific Instruments.
Brown & Hall—The Orifice Meter and Gas Measurement.
Brown & Sharpe Mfg. Co.—The Micrometer; the history, how made, the principle, how to read, etc.
Brown & Sharpe Mfg. Co.—Brown & Sharpe Handbook; A guide to young machinists.
Browne—Handbook of Sugar Analysis.
Browne—Water Meters: Comparative Tests of Accuracy, etc.
Browning—How to Work with the Spectroscope; A Handbook.
Brownlee—Boiler Plant Testing.
Burgess & Le Chatelier—Measurement of High Temperatures.
Burns—Workshop Gauges and Measuring Devices.
Campbell—An Account of the Principles of Measurement and Calculation.
Carpenter—Geographical Surveying; Its Uses, Methods and Results.
Carpenter & Diederichs—Experimental Engineering and Manual for Testing.
Chamat—Elementary Chemical Microscopy.
Chapman—The Elements of Astronomy for Surveyors.
Clark—Applied X-Rays.
Clark—The Determination of Hydrogen ions.
Coles—Critical Microscopy.
Collins—Commercial Electrical Testing.
Comstock—Textbook of Field Astronomy for Engineers.
Cooke & Dibdin—Electric Lighting and Photometry.
Coradi—Coradi Planimeters: Description and Instructions for Use and Testing.
Cowdrey & Adams—Materials Testing; Theory and Practice.
Craft—Circuit Troubles and Testing.
Cross—Handbook of Petroleum, Asphalt and Natural Gas.
Cross & Cole—Modern Microscopy.
Curtis—The Testing of Yarns and Fabrics.
Darling—Pyrometry; a Practical treatise on the Measurement of High Temperatures.
Davidge—Optical Instruments Simply Explained
Davidson—Manual of Seismology.
Davy & Farnham—Microscopic Determination of the Ore Minerals.
Dennis—Gas Analysis.
Dibdin—Practical Photometry.
Disney, Hill and Baker—Origin and Development of the Microscope.
Dobson, Griffith & Harrison—Photographic Photometry.
Dowd and Curtis—Modern Gaging Practice.
Drysdale & Jolley—Electrical Measuring Instruments, 2 Vols.
Duff & Ewell—Physical Measurements.
Duncan—Air Navigation and Meteorology.
Durham—Mine Surveying.
Earle and Earle—The Making and Testing of Portland Cement and Concrete.
Eason—The Flow and Measurement of Air and Gases.
Eaton and Others—Aircraft Instruments.
Edgecumbe—Industrial Electrical Measuring Instruments.
Evans—The Determination of Minerals under the Microscope.
Farmer—Electrical Measurements in Practice.
Ferry and Others—Practical Pyrometry.
Fisher—The Potentiometer and its Adjuncts.
Fleming—Handbook for the Electrical Laboratory and Testing Rooms, 2 Vols.
Flynn—Flow of Water in Open Channels, Pipes, Conduits, Sewers.
Fox and Bowles—The Analysis of Pigments, Paints and Varnishes.
Fraprie—How to Choose and Use a Lens.
Gage—The Microscope; an Introduction to Microscopic Methods and to Histology.
Gardner—Physical and Chemical Examination of Paints, Varnishes, Lacquers and Colors.
Gardner—Paint Technology and Tests.
Gaster & Dow—Modern Illuminants and Illuminating Engineering.
General Electric Co.—Instructions for Testing Electrical Apparatus.
General Electric Co.—General Data on Thomson Watthour Meters.
Gerhardi—Electricity Meters, their Construction and Management.
Gilbert—Gas Meters; Their Construction, Use, Fixing, Inspection and Maintenance.
Gill—Engine Room Chemistry.
Gill—Short Handbook of Oil Analysis.
Gill—Gas and Fuel Analysis for Engineers.
Gleichen—Theory of Modern Optical Instruments.
Goldsmith—Optical Methods in Control and Research Laboratories.
Goodwin—Elements of the Precision of Measurements on Graphical Methods.
Gray—Theory and Practice of Absolute Measurements in Electricity and Magnetism (2 Vols. 1888).
Greaves and Wrighton—Practical Microscopical Metallography.
Gregg—Aeronautical Meteorology.
Griffin—Technical Methods of Analysis.
Griffiths—Methods of Measuring Temperature.
Griffiths—Engineering Instruments and Meters.
Griffiths—Thermal Measurement of Energy.
Griffiths—Pyrometers.
Gunther—Historic Instruments for the Advancement of Science.

Gurley—Manual of the Principal Instruments Used in American Engineering and Surveying Manufactured by W. & L. E. Gurley.
Haldane—Methods of Air Analysis.
Hall—How to Use the Microscope.
Hall & Williams—Chemical and Metallographic Examination of Iron, Steel and Brass.
Hamilton—Gages, Gaging and Inspection.
Hanausek translated by Winton—Microscopy of Technical Products.
Haskins—Galvanometer and its Uses.
Haswell—Horology, the Science of Time Measurement and the Construction of Clocks, Watches and Chronometers.
Hatt & Scofield—Laboratory Manual of Testing Materials.
Hicks—The Laboratory Book of Mineral Oil Testing.
Higgins—Phototopography; a Practical Manual of Photographic Surveying Methods.
Higgins—Thermometry.
Hinds and Randles—Handbook of Photomicrography.
Hodgman—Manual of Land Surveying, Comprising an Elementary Course of Practice with Instruments.
Hole—The Distribution of Gas.
Hornby—The Gas Engineers Laboratory Handbook.
Horner—Weather Observations and Aids to Forecasting.
Hosmer—Text Book on Practical Astronomy.
Hubbard—Laboratory Manual of Bituminous Materials.
Illinois Steel Co.—The Venturi Meter as an Instrument for the Measurement of Liquids and Gases.
Ingram—Geodetic Surveying and Adjustment of Observations.
Irwin—Oscillographs; a Concise Treatise on the Theory, Construction and Use of Electro-Magnetic, Hot-Wire, Electrostatic and Cathode Ray Oscillographs.
Ives—Airplane Photography.
James—Testing of Electricity Meters and their Accessories.
Jameson—Weather and Weather Instruments for the Amateur.
Jansky—Electrical Meters.
Jeffers—Nautical Surveying.
Jennings—How to Photograph Microscopic Objects.
Johannsen—Manual of Petrographic Methods.
Johnson & Earle—Practical Tests for the Electrical Laboratory.
Johnson—Rapid Methods for the Chemical Analysis of Special Steels, Steel Making Alloys, their Ores and Graphites.
Jones & Griffiths—Aerial Surveying by Rapid Methods.
Judge—The Testing of High Speed Internal Combustion Engines.
Judge—Stereoscopic Photography.
Karapetoff—Experimental Electrical Engineering (2 Vols.)
Karapetoff—Elementary Electrical Testing.
Kaye—High Vacua.
Kaye—Practical Application of X-Rays.
Kempe—Handbook of Electrical Testing.
Kennelly—Electrical Vibration Instruments.
Kennelly & Wilkinson—Practical Notes for Electrical Instruments.
Kershaw—Fuel, Water and Gas Analysis for Steam Users.
Keufel & Esser—Pocket Manual of the Engineer's Solar Transit.
King—Handbook of Hydraulics.
King—Graphical Methods of Plotting from Air Photographs.
Kinzbrunner—Testing of Alternating Current Machines in Laboratories and Test Rooms.
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Martin—The Measurement of Electric Currents.
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McAdie—Principles of Aerography.
Merriman and Brooks—Handbook for surveyors (1897).
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Yarril—Maintenance and Repair of Electrical Measuring Instruments.
Yoe—Photometric Chemical Analysis (Vol. I Colorimetry, Vol. II, Nephelometry).
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Ambronn & Frey—Das Polarisationsmikroskop.
Apt—Isolationsmessungen und Fehlerbestimmungen an elektrischen Starkstromleitungen.
Aron—Die Messung der elektrischen Grossen.
Ascher—Die Schmiermittel, ihre Art, Pruefung und Verwendung.
Bahrdt—Physikalische Messungsmethoden.
Bauer & Deiss—Probenahme und Analyse von Eisen und Stahl.
Becker—Die Roentgenstrahlen als Hilfsmittel fuer die chemische Forschung.
Bergtold—Kurzgefasstes Handbuch der Elektrizitaets-zaehlertechnik.
Berl & Ranis—Die Andwendung der Interferometrie in Wissenschaft und Technik.
Berndt—Technische Winkelmessungen.
Berndt—Hilfseinrichtungen fuer den Gebrauch von Elektrometern.
Berndt—Elektrometer.
Berndt & Schulz — Grundlagen und Geraete technischer Laengenmessungen.
Bertelsmann—Lichttechnik.
Biber—Instrumente zur Geschwindigkeits—bzw. Volumenmessung gasfoermiger und tropfbarfluessiger Koerper.
Block—Handbuch der technischen Messgeraete.
Block—Messen und Waegen.
Bongards—Feuchtigkeitsmessung.
Born—Isostasie und Schwerenmessung.
Brueckmann—Elektrizitaetszaehler und Wandler, deren Theorie, Beschreibung und Eichung.
Burgess & Le Chatelier—Die Messung hoher Temperaturen.
Classen & Danneel—Quantitative Analyse durch Elektrolyse.
Cramer—Elektrische Messkunde.
Defant—Wetter und Wettervorhersage; synoptische Meteorologie.
Demuth—Die Materialpruefung der Isolierstoffe der Elektrotechnik.
Deutsch—Tafeln ueber die mechanische Pruefung der Metalle.
Doehmer—Die Brinellsche Kugeldruckprobe.
Dokulil—Anleitung fuer die Herstellung und Justierung Geodaetischer Instrumente (2 Vols.)
Drucker—Ostwald Luther Hand und Hilfsbuch zur Ausfuehrung physiko-chemischer Messungen.
Ehringhaus—Das Mikroskop, seine wissenschaftliche Grundlage und Anwendung.
Engelmann—Altwissenschaftliche Instrumente, Sammlung Mensing (2 Vols).
Felgentraeger—Theorie, Konstruktion und Gebrauch der feineren Hebelwagen.
Geiger—Mechanische Schwingungen und ihre Messung.
Geldermann—Verschleierung der Angaben von Elektrizitaetszaehlern und Abhilfe.
Gerland—Die Anwendung der Elektrizitaet bei Registrirenden Apparaten.
Germer—Die Grundlagen der Dampfmessung nach dem Differenzdruckprinzip.
Giebel—Das Pendel.
Gleichen—Die Theorie der modernen optischen Instrumente.
Glocker—Materialpruefung mit Roentgenstrahlen.
Goldstein—Die Messwandler.
Gollmer—Ueber Fehlerortsbestimmungen an Kabelleitungen.
Grailich—Krystallographisch - optische Untersuchugen.
Gramberg—Maschinentechnisches Versuchswesen (2 Vols.)
Gross—Herstellung und Pruefungsmethoden des Stahls.
Gruhn—Elektrotechnische Messinstrumente.
Gumlich—Leitfaden der magnetischen Messungen mit besonderer Berucksichtigung der in der Physikalisch-Technischen Reichsanstalt.
Guenther—Mikroskopie fuer jedermann.
Guenther & Kroencke—Messtechnik fuer Radio Amateure.
Gutenberg—Grundlagen der Erbebenkunde.
Gutenberg—Lehrbuch der Geophysik (4 Vols.)
Haalck—Die Magnetischen Verfahren der Angewandten Geophysik.
Hager & Tobler—Das Mikroskop und seine Anwendung.
Harrwitz—Taschenbuch fuer Praezisionmechaniker, Optiker, Elektromechaniker und Glasinstrumentenmacher.
Hausrath—Apparate und Verfahren zur Aufnahme und Darstellung von Wechselstromkurven und elektrischen Schwingungen.
Heerman—Faerberei und textilchen Untersuchungen.
Heermann—Mechanisch und physikalisch-technische Textiluntersuchungen.
Heinke—Die Messtechnik.
Heinke—Wechselstrommessungen und Magnetische Messungen.
Henning—Die Grundlagen, Methoden und Ergebnisse der Temperaturmessung.
Herrmann—Die elektrischen Messinstrumente.
Herrmann—Die elektrische Messtechnik.
Herzberg—Papierpruefung.
Herzfeld—Die technische Pruefung der Garne und Gewebe.
Herzog—Polster Rosshaar und seine Pruefung.
Herzog—Die mikroskopische Untersuchung der Seide.
Herzog—Die Unterscheidung der Flachs und Hauffaser.
Heyn—Geschwindigkeitsmesser mit Reibungsgetriebe.
v. Hippel—Die Elektronen Roehre in der Messtechnik.
Hoffmann—Thermometrie in Staehlers Arbeitsmethoden der anorganischen Chemie.
Hofmann—Praktische Schemas fuer Zaehler und Messinstrumente.
Hofmann—Systempruefungen neuester Wechselstrom-Zaehlertypen.
Holborn & v. Angerer—Mess Methoden und Mess Technik.
Hoppe—Elektrotechnische Messinstrumente und Messmethoden.
Hort & Huelsenkamp—Untersuchung von Spannungs und Schwingsmessern fuer Bruecken.
Hugershoff—Die geodaetischen und astronomischen Instrumente der Forschungsreisenden.
Hund—Hochfrequenzmesstchnik.
Jaeger—Die Normalelemente und ihre Anwendung in der elektrischen Messtechnik.
Jaeger—Elektrische Messtechnik.
Jaenichen—Lichtmessungen mit Selen.
Jahn—Messungen an elektrischen Maschinen.
Joos, v. Angerer & Stark—Anregung der Spektren, Apparate und Methoden der Spektroskopie, Starkeffekt.

Kafka—Taschenbuch der Untersuchungsmethoden.
Kantner & Herr—Die Verwendbarkeit der Roentgenverfahren.
Kayser & Konen—Handbuch der Spectroscopie (7 Vols.)
Keinath—Die Technik der elektrischen Messgeraete (2 Vols.)
Keinath—Elektrische Temperatur Messgeraete.
Keinath—Internationale Regeln fuer die Betriebssicherheit von Messgeraeten.
Knoblauch & Hencky—Anleitung zu genauen technischen Temperaturmessungen.
Koegler—Isolationsmessung und Fehlerortsbestimmung in elektrischen Starkstromanlagen.
Konen—Herstellung und Messung des Lichts.
Koenig—Die Fernrohre und Entfernungsmesser.
Koenigswerther—Konstruktion und Pruefung der Elektricitaetszaehler.
Kolthoff—Der Gerbrauch von Farbindicatoren.
Kropf—Laboratoriumsbuch fuer den Eisenhuetten und Stahlwerkschemiker.
Krug—Loetrohrprobierkunde.
Krug—Die Praxis des Eisenhuettenchemikers.
Krukowiski—Die Grundzuege der Zaehlertechnik nebst einer Einfuehrung in die allgemeine Elektrotechnik.
Kruess & Kruess—Kolorimetrie und quantitative spektralanalyse in ihrer Anwendung in der Chemie.
Kurrein—Messtechnik.
Langer & Thome—Anleitung zu maschinentechnischen Messungen und Untersuchungen.
Ledebur—Leitfaden fuer Eisenhuettenlaboratorien.
Lifschitz—Spektroskopie und Kolorimetrie.
Linker—Elektrotechnische Messkunde.
Litinsky—Messung Grosser Gasmengen.
Lowe—Optische Messungen.
Lummer—Grundlagen, Ziele und Grenzen der Leuchttechnik.
Lunge & Berl—Chemisch-technische Untersuchungsmethoden (4 vols.)
Mahr—Die Gewindelehre und der Gewindeaustauschbau.
Mahr—Die Grenzlehre.
Mann—Beitrag zur Kenntnis der Wassermessung mittels Messschirms.
Mark—Die Verwendung der Roentgenstrahlen in Chemie und Technik.
Martens & Heyn—Handbuch der Materialienkunde fuer den Maschinenbau (2 Vols.)
Mayer—Einfuehrung in die Mikroskopie.
Mayer—Die Knickfestigkeit.
Memmler—Das Materialpruefungswesen.
Michel—Edelmetall Probierkunde nebst einigen Unedelmetallbestimmungen.
Mislowitzer—Die Bestimmung der Wasserstoffionenkonzentration von Fluessigkeiten.
Moellinger—Wirkungsweise der Motorzaehler und Messwandler.
Mueller—Materialpruefung und Baustoffkunde fuer den Maschinenbau.
Neuburger—Kristallbau und Roentgenstrahlen.
Neuburger—Roentenographie des Eisens und seiner Legierungen.
Norden—Elektrolytische Zaehler.
Ostwald & Luther—Hand und Hilfsbuch zur Ausfuehrung Physiko-Chemischer Messungen.
Ott—Instrumentenkunde der praktischen Hydrometrie.
Ott—Theorie und Konstantenbestimmung des hydrometrischens Fluegels.
Peters—Thermoelemente und Thermosaeulen.
Physikalisch Technischen Reichsanstalt—Prueford ung fuer elektrische Messgeraete.
Poebing—Zur Bestimmung stroemender Fluessigkeitsmengen im offenen Gerinne.
Pomp & Schweinitz—Der Herbert-Pendelhearte-pruefer und seine Eignung fuer die Werkstoffpruefung.
Preuss, Berndt, v. Schwarz—Die praktische Nutzanwendung der Pruefung des Eisens durch Aetzverfahren und mit Hilfe des Mikroskopes.
Prey—Einfuehrung in die Geophysik.
Rakusin—Die polarimetrie der Erdoele; ihre Geschichte und gegenwaerte Entwicklung.
Randhagen—Gleichstrommessungen.
Rapatz & Meyer—Handbuch der mikroskopischen Technik.
Raphael—Isolationsmessungen und Fehlerbestimmungen elektrischen Starkstromleitungen.
Reiff—Die Instrumente zur Messung der Staerke elektrischer Stroeme.
Reiff—Ueber Elektrometer.
Riebensahn & Traeger—Werkstoffpruefung.
Rinne—Elementare Anleitung zu Kristallographisch-Optischen Untersuchungen vornehmlich mit Hilfe des Polarisations Mikroskops.
Rohde—Die Geschichte der wissenschaftlichen Instrumente vom Beginn der Renaissance bis zum Aussgang des 18 Jahrhunderts.
v. Rohr—Die binokularen Instrumente.
v. Rohr—Die Theorie der optischen Instrumente.
Romeis—Taschenbuch der mikropischen Technik.
Rosenbusch—Mikroskopische Physiographie der Mineralien and Gesteine.
Sachs & Fiek—Der Zugversuch.
Samter & Schuchardt—Analytische Schnellmethoden.
Sarnetzky—Grundzuege der Luft und Erdbildmessung.
Scheel & Ebert—Fernthermometer.
Scheibe—Indikatoren, Messmethoden und Wellenmesser.
Schiller—Hydro und Aerodynamik.
Schilling & Bunte—Handbuch der Gastechnik. Vol. 4 Messung des Gases.
Schmidt—Die Messung von Gastemperaturen.
Schmidt—Elektrizitaetszaehler, Zaehlerpruefung und Zaehlereicheinrichtungen.
Schmiedel—Die Pruefung der Elektrizitaetszaehler.
Schultz & Gleichen—Die Polarisationsapparate und Ihre Verwendung.
Schulze & Vollhardt—Werkstoffpruefung fuer Maschinen und Eisenbau.
Schwappack—Leitfaden der Holzmesskunde.
Seliger—Die stereokopische Messmethode in der Praxis.
Seufert—Brand Seufert, Technische Untersuchungsmethoden zur Betriebsueber.
Seufert—Anleitung zur Durchfuehrung von Versuchen an Dampfmaschinen, Dampfkesseln, Dampfturbinen und Verbrennungakraftmaschinen.
Siegbahn—Spektroskopie der Roentgenstrahlen.
Skirl—Elektrische Messungen.
Skirl—Messgeraete und Schaltungen zum Parallelschalten von Wechselstrom-Maschinen.
Skirl—Messgeraete und Schaltungen fuer Wechselstrom-Leistungsmessungen.
Springer—Laboratoriumsbuch fuer die Glasindustrie.
Staus—Der Indikator und seine Hilfseinrichtungen.
Staus—Maschinenuntersuchungen (2 Vols.)
Staus—Der Genauigkeitsgrad von Fluegelmessungen bei Wasserkraftanlagen.
Stern—Isolationsmessung und Fehlerortabestimmung.
Thieme—Temperaturmessmethoden.
Trendelburg—Sterioskopische Raummessung an Roetgenaufnahmen.
Ulbricht—Kugelphotometer.

Upperborn—Lehrbuch der Photometrie.
Vita Massenez—Chemische Untersuchungsmethoden fuer Eisenhuetten und Nebenbetriebe.
Voss—Die Messung elektrischer Widerstaende.
Wawrziniok—Handbuch des Materialpruefungswesens fuer Maschinen und Bauingenieure.
Weber—Elektrotechnische Messkunde.
Weigert—Optische Methoden der Chemie.
Weinstein—Handbuch der Physikalischen Massbestimmungen (2 Vols.)
Wiederman—Handbuch der Elektrotechnik.
Wilke—Die Elektrischen Mass und praecisions Instrumente.
Wirz—Beitrag zur Theorie und Untersuchung der Ferrarismessgeraete.
Woytacek—Lehrbuch der Glasblaeserei.
Zingler—Theorie der zusammengesetzten Waagen.

A careful check of the abstract services in List 3 will often yield the desired information.

### List 3—Abstract Services

Abstract Bulletin, Research Laboratory, Eastman Kodak Company.
Abstract Bulletin, Nela Park Research Laboratory, General Electric Company.
Automotive Abstracts.
Bibliographia Chimica.
British Chemical Abstracts.
Bulletin of Abstracts, American Gas Association.
Chemical Abstracts, American Chemical Society.
Chemical Reviews.
Engineering Index, also the New Engineering Card Index.
Industrial Arts Index.
INSTRUMENTS Monthly Current Literature Review.
Science Abstracts—Section A, Physics; Section B, Electrical Engineering.
Stahl und Eisen, Monthly Abstract Section.
Technische Zeitschriftenshau.

In general the next procedure would be to go through the yearly indexes of periodicals in Lists 4 and 5 carefully, which, though somewhat laborious, enables a thorough search to be made.

### List 4—Periodicals Confined Either Wholly or in Part to Instruments

Allgemeine Vermessungs Nachrichten.
Instrument World.
INSTRUMENTS.
Journal of the Optical Society of America and Review of Scientific Instruments.
Journal of Research—Bureau of Standards.
Journal of Scientific Instruments.
Messtechnik.
Scale Journal.
Zeitschrift fuer Instrumentenkunde.
Zeitschrift fuer Feinmechanik und Praezision.
Zeitschrift fuer Vermessungswesen.

List 5 gives the above and in addition a number of periodicals which occasionally have articles on instruments and measurements. This list is given on pages 34 to 37.

(Continued in the February issue)

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## To the Instrument Companies

IN order to keep the readers of INSTRUMENTS in touch with the latest developments in industrial and scientific instruments, the editor again urges all manufacturers of such instruments to keep him informed of all new instruments or important improvements made by them as soon as they appear, by letting him have descriptions of about 1000 words including construction, performance, and applications.

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Advertising does not actually sell goods, nor is it the fundamental purpose of advertising to sell goods. Rather it is used to create a favorable state of mind among possible purchasers.

# Current Literature Review

**Abstracts on instruments of interest to instrument readers**

During the year 1929 the following periodicals will be searched regularly for information and articles on instruments.

The references marked with an asterisk will be used only if the original periodical is not available.

| Abbreviations used in INSTRUMENTS | Full Title of Periodical | Place of Publication |
|---|---|---|
| Abs. Bull.* | Abstract Bulletin, Research Laboratory | General Electric Co., Nela Park Cleveland, Ohio. |
| A. E. G. Mitt. | A.E.G. Mitteilungen | Berlin NW 40, Friedrich Karl-Unfer 2-4, Germany |
| Allgem. Ver. Nach. | Allegemeine Vermessugs Nachrichten | R. Reiss, Liebenwerda, Germany |
| Amer. Gas. Jl. | American Gas Journal | 53 Park Place, New York, N. Y. |
| Amer. Gas. Ass. | American Gas Association Monthly | 342 Madison Ave., New York, N. Y. |
| Amer. Jl. Sci. | American Journal of Science | New Haven, Conn. |
| Amer. Mach. | American Machinist | 10 Ave. at 36 St., New York, N.Y. |
| Analyst | Analyst | W. Heffer & Sons, Cambridge, Eng. |
| Ann. Physique | Annales de Physique | 120 Boulevard St. Germain, Paris, France |
| Arch. Elekt. | Archiv fuer Electrotechnik | J. Springer, Berlin, Germany |
| Arch. Waermew. | Archiv fuer Waermewirtschaft und Dampkesselwesen | V.D.I. Verlag, Berlin NW7, Dorotheenstr, 40, Germany |
| Astro. Jl. | Astrophysical Journal | Univ. of Chicago Press, Chicago |
| Auto. Abs.* | Automotive Abstracts | Ohio State Univ., Columbus, Ohio |
| Aviation | Aviation | 250 W. 57 St., New York, N.Y. |
| Bell Jl. | Bell System Technical Journal | 195 Broadway, New York, N.Y. |
| Bell Quarterly | Bell Telephone Quarterly | Amer. Telephone & Telegraph Co. New York, N.Y. |
| Ber. d. Chem. Ges. | Berichte der Deutchen Chemischen Gesellschaft | Berlin W 10, Corneliusstr. 3, Germany |
| Bibliographia Chimica* | Bibliographia Chimica | Verlag Chemie, Leipzig, Bosestr 2, Germany |
| Bild. u. Luftbild. | Bildmessung und Luftbildwesen | R. Reiss, Liebenwerda, Germany |
| Brit. Chem. Abs.* | British Chemical Abstracts Bureau of Chemical Abstracts | Central House 46, Finsbury Sq., London, E.C. 2, England |
| Bull. Abs.* | Bulletin of Abstracts | American Gas Association, Easton, Pa. |
| Bull. Bur. Mines | Bulletin of the Bureau of Mines | Bureau of Mines, Washington, D.C. |
| Bull. Brit. C.I. Res. Ass. | Bulletin of the British Cast Iron Research Association | 24 St. Paul's Square, Birmingham, England |
| Bull. Soc. Francaise Elect. | Bulletin de la Societe Francaise des Electriciens | 12 Rue de Stael, Paris 15e France |
| Ceramic Age | Ceramic Age | 170 Roseville Ave., Newark, N.J. |
| Ceramic Ind. | Ceramic Industry | 407 So. Dearborn St., Chicago, Ill. |
| Chem. Abs.* | Chemical Abstracts | American Chemical Society, Easton, Pa. |
| Chem. Age | Chemical Age | 154 Fleet St., London, E.C. 4, England |
| Chem. & Met. | Chemical & Metallurgical Engineering | 10 Ave. at 36 St., New York, N.Y. |
| Chem. Rev.* | Chemical Reviews | Williams & Wilkins Co., Baltimore, Md. |
| Chem. Zg. | Chemiker-Zeitung | Verlag der Chemiker-Zeitung, Cothen (Anhalt) Germany |
| Chem. Zentralbl. | Chemisches Zentralblatt | Verlag Chemie, Corneliusstr. 3, Berlin W 10, Germany |
| Coll. Guard. | Colliery Guardian & Journal of the Coal & Iron Trades | 31 Furnival St., Holborn, London, E.C. 4, England |
| Combustion | Combustion | 43 Broad St., New York, N. Y. |
| Compr. Air Mag. | Compressed Air Magazine | Bowling Green Bldg., 11 Broadway, New York, N.Y. |
| Concrete | Concrete | 139 North Clark St., Chicago, Ill. |
| Elect. Jl. | The Electric Journal | Keenan Bldg., Pittsburgh, Pa. |
| Elect. Light | Electric Light & Power | 360 N. Michigan Ave., Chicago, |
| Elect. Comm. | Electrical Communication | International Standard Electric Corp., New York, N.Y. |

| Abbreviations used in INSTRUMENTS | Full Title of Periodical | Place of Publication |
|---|---|---|
| El. Rev. | Electrical Review | 4 Ludgate Hill, London E.C. 4, England |
| El. World | Electrical World | 10 Ave. at 36 St., New York, N.Y. |
| Electrician | Electrician | 8 Bouverie St., London, E.C. 4, England |
| Electricien | L'Electricien | 92 Rue Bonaparte, Paris 6, France |
| E. u. M. Wien | Elektrotechnik und Maschinenbau | Theobaldgasse 12, Vienna VI, Austria |
| E. T. Z. | Elektrotechnische Zeitschrift | Linkstr, 23/23, Berlin W. 9, Germany |
| Engg. Boiler House Rev. | Engineering & Boiler House Review | 13 Fisher St., Southampton Row, London, W.C. 1, England |
| Engg. News-Rec. | Engineering News Record | 10 Ave. at 36 St., New York, N.Y. |
| Engg. Min. Jl. | Engineering & Mining Jorunal Press | 10 Ave. at 36 St., New York, N.Y. |
| Engg. Progress | Engineering Progress | Progressus, Krausenstr, 38/39, Berlin SW 19, Germany |
| Feuerungstechn. | Feurungstechnik | Otto Spamer, Heinrichstr, 9, Leipzig C 1, Germany |
| Fonderie Mod. | La Fondernie Moderne | Aossication Technique de Fonderie 15 Rue Bleue, Paris 9e ,France |
| Foundry | Foundry | Penton Publishing Co., Cleveland, Ohio |
| Foundry Trade Jl. | Foundry Trade Journal | 49 Wellington St., Strand, London, W.C. 2, England |
| Fuel Sc. Pr. | Fuel in Science & Practice | 30 Furnival St., London E.C. 4, England |
| Gas Age-Record | Gas Age-Record | 52 Vanderbilt Ave., New York, N.Y. |
| Gas. Jl. | Gas Journal | 11 Bolt Court, Fleet St., London E.C. 4, England |
| Gas Wasserfach | Das Gas-und Wasserfach | R. Oldenbourg, Gluckstr. 8, Munchen, Germany |
| Gl. Appar | Glas und Apparat | R. Wagner & Sohn, Weimar, Germany |
| Gas World | Gas World | 154 Fleet St., London E.C. 4, England |
| G. E. Rev. | General Electric Review | General Electric Co. ,Schenectady, N.Y. |
| Giess-Zg. | Giesserei-Zeitung | Jerusalemer Str. 46/49, Berlin SW 19, Germany |
| Gl. Ind. | Glas Industrie | Spaeth & Linde, Genthiner Str. 42, Berlin Y 10, Germany |
| Glass | Glass | 65 Victoria St., London SW 1, England |
| Glass Ind. | Glass Industry | 19 Liberty St., New York, N.Y. |
| Glueckauf | Glueckauf | Friedrichstr. 2, Essen, Germany |
| Heat. Ventil. Mag. | Heating & Ventilating Magazine | 1123 Broadway, New York, N.Y. |
| Il. Eng. | Illuminating Engineer | 32 Victoria St., London SW 1, England |
| Ind. Engg. Chem. | Industrial & Engineering Chemistry | 1709 G St., N.W., Washington, D.C. |
| Ind. Power | Industrial Power | 608 So. Dearborn St. ,Chicago, Ill. |
| Instr. World | Instrument World | 72 Fleet St., London, E.C. 4, England |
| Iron Age | The Iron Age | 239 West 39 St., New York, N.Y. |
| Ir. Coal Tr. Rev. | Iron and Coal Trades Review | 49 Wellington St., Strand, London WC 2, England |
| Ir. St. Eng. | Iron & Steel Engineer | 1706 Empire Bldg., Pittsburgh, Pa. |
| Ir. Tr. Rev. | Iron Trade Review | Penton Publishing Co., Cleveland, Ohio |
| Jl. Amer. Ceram. Soc. | Journal of the American Ceramic Society | 2525 N. High St., Columbus, Ohio |
| Jl. Amer. Chem. Soc. | Journal of the American Chemical Society | Easton, Pa. |
| Jl. A. I. E. E. | Journal of American Institute of Electrical Engineers | 39 West 39 St., New York, N.Y. |
| Jl. Amer. Soc. Heat. Ventil. | Journal of the American Society of Heating & Ventilating Engineers | 20 & North Hampton Sts. Easton, Pa. |
| Jl. Amer. Soc. Naval Engrs. | Journal of American Society of Naval Engineers | Washington, D. C. |
| Jl. Amer. Soc. Ref. Engrs. | Journal of the American Society of Refrigerating Engineers | 37 West 39 St., Ne wYork, N.Y. |
| Jl. Amer. Waterw. Ass. | Journal of the American Waterworks Association | Mt. Royal & Guilford Ave., Baltimore, Md. |
| Jl. Chem. Soc. | Journal of the Chemical Society | 33 Paternoster Row, London EC 4, England |
| Jl. Chim. Phys. | Journal de Chimie Physique | 49 Boulevard Saint-Michel, Paris (Ve), France |
| Jl. Franklin Inst. | Journal of the Franklin Institute | 15 South 7 St., Philadelphia, Pa. |
| Jl. Geology | Journal of Geology | Univ. of Chicago Press, Chicago, |
| Jl. Inst. Elect. Engrs. | Journal of the Institution of Electrical Engineers | Savoy Place, Victoria Embankment, London, WC 2, England |

| Abbreviations used in INSTRUMENTS | Full Title of Periodical | Place of Publication |
|---|---|---|
| Jl. Inst. Pet. Tech. | Journal of the Institution of Petroleum Technologists | Aldine House, Bedford St., Strand, London, WC 2, England |
| Jl. Opt. Soc. | Journal of the Optical Society of American and Review of Scientific Instruments. | Cornell University, Ithaca, N.YY. |
| Jl. Phys. Chem. | Journal of Physical Chemistry | Baker Laboratory, Ithaca, N.Y. |
| Jl. Phys. Rad. | Journal de Physique et le Radium | 10 Rue Vanquelin, Paris V, France |
| Jl. Royal Aero Soc. | Journal of the Royal Aeronautical Society | 7 Albermarle St., Piccadilly, London W 1, England |
| Jl. Royal Micro. Soc. | Journal of the Royal Microscopical Society | 20 Hanover Square, London W 1, England |
| Jl. Scient. Instr. | Journal of the Scientific Instruments | Cambridge Univ. Press, Fetter Lane, London EC 4, England |
| Jl. Soc. Chem. Ind. | Journal of the Society of Chemical Industry | 46 Finsbury Square, London EC 2, England |
| Jl. Soc. Glass Tech. | Journal of the Society of Glass Technology | The University, Sheffield, England |
| Machinery | Machinery | 140 Lafayette St., New York, N.Y. |
| Mech. Engg. | Mechanical Engineering | 29 West 39 St., New York, N.Y |
| Messtechnik | Messtechnik | Wilhelm Knapp, Muhlweg 19, Halle (Saale), Germany |
| Met. Ind. (N.Y.) | Metal Industry, New York | 99 John St., New York, N.Y. |
| Met. Ind. (Lond.) | Metal Industry and the Iron Foundry | 22 Henrietta St., London WC 2, England |
| Metal Erz | Metall und Erz | Muhlweg 19, Halle (Saale), Germany |
| Military Eng. | Military Engineer | Society of American Military Engineers, Mills Bldg., Washington, D.C. |
| Min. Met. | Mining and Metallurgy | 29 West 39 St., New York, N.Y. |
| Mitt. K. W. Inst. Eisenforsch | Mitteilungen aus dem Kaiser Wilhelm Institute fuer Eisenforschung | Schliessfach 664, Duesseldorf, Germany |
| Mitt. Materialpruef. | Mitteilungen aus dem Materialpruefungsamt Kaiser-Wilhelm Institute fuer Metallforschung | Julius Springer, Linkstr, 23/24, Berlin W9, Germany |
| Motor Age | Motor Age | 5 So. Wabash Ave., Chicago, Ill. |
| Nat. Eng. | National Engineer | 407 So. Dearborn St., Chicago, Ill. |
| Nat. Gas | Natural Gas | 9 W. 4 St., Cincinnati, Ohio |
| Oil Age | Oil Age | Insurance Exchange ldg., Los Angeles, Calif. |
| Oil Eng. Power | Oil Engine Power | 220 West 42 St., New York, N.Y. |
| Paper Ind. | Paper Industry | 356 Monadnock Bldg., Chicago |
| Paper Tr. Jl. | Paper Trade Journal | 10 East 39 St., New, N.Y. |
| Petroleum | Petroleum | Courbierestr. 3, Berlin W 62, Germany |
| Phys. Rev. | Physical Review | American Physical Society, 1500 University Ave., S.E. Minneapolis, Minn. |
| Phys. Ber. | Physikalisch Berichte | Vieweg & Sohn, Vor der Burg 18, Friedr., Braunschweig, Germany |
| Phys. Zeits. | Physikalische Zeitschrift | Konigstr. 2, s. Hirzel, Leipzig, Germany |
| Pop. Ast. | Popular Astronomy | Goodsell Observatory of Carleton College, Northfield, Minn. |
| Power | Power | 10 Ave. at 36 St., New York, N.Y. |
| Power Pl. Engg. | Power Plant Engineering | 537 So. Dearborn St., Chicago, Ill. |
| Proc. A.S.C.E. | Proceedings of the American Society of Civil Engineers | 33 West 39 St., New York, N.Y. |
| Proc. A.S.T.M. | Proceedings of the American Society for Testing Materials | 1315 Spruce St., Philadelphia, Pa. |
| Proc. Engrs. Soc. W. Pa. | Proceedings of the Engineers' Society of Western Pennsylvania | William Penn Hotel, Pittsburgh, Pa. |
| Proc. Inst. Radio Engrs. | Proceedings of the Institute of Radio Engineers | 21 Center St., Middletown, N.Y. |
| Proc. Inst. Mech. Engrs. | Proceedings of the Institution of Mechanical Engineers | Storey's Gate, St. James' Park, London, SW 1, England |
| Proc. Nat. Acad. Sc. | Proceedings of the National Academy of Sciences | Harvard School of Public Health, Boston 17, Mass. |
| Proc. Naval Inst. U.S. | Proceedings Naval Institute of the United States | Annapolis, Maryland |
| Proc. Phys. Soc. Lond. | Proceedings of the Physical Society of London | 3-9 Dane St., High Holborn, London WC 1, England |
| Report. Sc. & Ind. Res. Dept. | Reports of Department of Scientific and Industrial Research | His Majesty's Stationary Office, London, England |
| Repr. Circ. Ser. Nat. Res. Council | Reprint and Circular Series of the National Research Council | 1701 Massachusetts Ave., Washington, D. C. |
| Rev. Fond. Mod. | La Revue de Fonderie Moderne | 15 Rue Bleue, Paris (9e), France |
| Rev. Gen. Elect. | Revue General de l'Electricite | 12 Place de Laborde, Paris 8, France |
| Rev. Gen. Sc. Pures. | Revue General des Sciences Pures et Appliques | 8 Place de L'Oden, Paris (6e), France |

| Abbreviations used in INSTRUMENTS | Full Title of Periodical | Place of Publication |
|---|---|---|
| Rock Products | Rocks Products | 542 S. Dearborn St., Chicago, Ill. |
| Science | Science | Science Press, Grand Central Terminal, New York, N.Y. |
| Science Abstracts* | Science Abstracts<br>Section A, Physics<br>Section B, Electrical Engineering | Spon & Chamberlain, 120 Liberty St., New York, N.Y. |
| Science Progress | Science Progress | John Murray, Albemarle St. W, London, England |
| Science Reports | Science Reports of Tohoku Imperial University | Maruzen Co., Ltd., Tokyo and Sendai, Japan |
| Sel. Engg. Papers | Selected Engineering Papers | Institution of Civil Engineers, Great George St., Westminster S.W. 1, London, England |
| Siemens Zeits. | Siemens-Zeitschrift | Siemensstadt bei Berlin, Germany |
| So. Power Jl. | Southern Power Journal | |
| Sprechsaal | Sprechsaal | Muller & Schmidt ,Coburg, Germany |
| St. u. E. | Stahl und Eisen | Schliessfach 664, Duesseldorf, Germany |
| T.P.B. of M. | Technical Papers, Bureau of Mines | Washington, D.C. |
| Tech. Aeron. | La Technique Aeronautique | 5 Rue de l'Isly, Paris, France |
| Techn. Zeits.* | Technische Zeitschriftenshau | Dorotheenstr. 40, Berlin NW 7, Germany |
| Trans. Electrochem. Soc. | Transactions of the American Electrochemical Society | Columbia Univ., New York |
| Trans. A.M. Soc. | Transactions of the American Microscopical Society | Urbana, Ill. |
| Trans. A.S.S.T. | Transactions of the American Society for Steel Treating | 7016 Prospect Ave., Cleveland, Ohio |
| Trans. Faraday | Transactions of the Faraday Society | 33 Paternoster Row, London E.C. England |
| Trans. I.E.S. | Transactions of the Illuminating Engineering Society | 29 W. 39 St., New York, N.Y. |
| Trans. I.M.E. | Transactions of the Institution of Mining Engineers | Cleveland House 225, City Road, London E.C. 1, England |
| Wasser & Gas | Wasser und Gas | Hertelstrasse 5, Berlin-Friedenau, Germany |
| Werkst. Techn. | Werkstattstechnik | Julius Springer, Linkstr. 23/24, Berlin W 9, Germany |
| Wiss. Ver. Siemens Konz. | Wissenschaftlichen Veroeffentlichungen des Siemens Konzerns | Berlin Siemensstadt, Germany |
| Zs. Angew Chem. | Zeitschrift fuer angewandte Chemie | Corneliusstr. 3, Berlin W 10, Germany |
| Zs. Feinmech. | Zeitschrift fuer Feinmechanik und Praezision | Gebr. Richters, Erfurt, Germany |
| Zs. Flugtechnik | Zeitschrift fuer Flugtechnik und Motorluftschiffahrt | R. Oldenburg, Munich, Germany |
| Zs. Instrument. | Zeitschrift fuer Instrumentenkunde | Julius Springer, Linkstr. 23/24, Berlin W 9, Germany |
| Zs. Metallk. | Zeitschrift fuer Metallkunde | Dorotheenstr. 40, Berlin NW 7, Germany |
| Zs. phys. Chem. | Zeitschrift fuer Physikalische Chemie | Markgrafenstr. 4, Leipzig, Germany |
| Zs. V. D. I. Zs. Vermess. | Zeitschrift fuer Vermessungswesen | Postfach 147, Stuttgart, Germany |
| Zwanglose Mitteilungen | Zwanglose Mitteilungen des Deutschen Verbandes fuer die Materialpruefungen der Technik | Berlin NW 7, Germany |

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# The Business Manager's Page

**Each month the Business Manager will have a message on this page.**

***When someone is looking for information on devices for measurement, inspection and control, he immediately thinks of***

## INSTRUMENTS

When we think of soap, "The skin you love to touch" snaps into focus; of smokes, behold we are walking a mile; coffee, "good to the last drop"; flour immediately brings up "eventually, why not now"; and toothpaste, "four out of five have it."

When a person desires information on instruments or devices for measurements, inspection and control —INSTRUMENTS immediately comes to mind.

It will pay you to investigate INSTRUMENTS as a medium to place your sales message before the instruments buyers and users of the United States.

## New Instruments

**Recently Developed by Instrument Manufacturers**

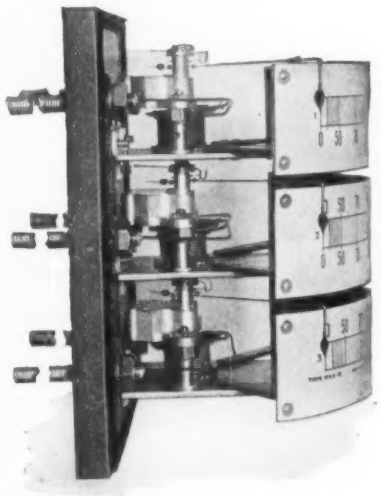
# Type HEA-3 Ammeter for Three Phase Circuits

*(Roller-Smith Company)*

THE Type HEA-3 ammeter is a new three phase ammeter developed for a large public utility. The HEA-3 ammeter is distinguished by its very long scale (7⅛ inches) and is most useful when very close readings are desired.

The Type HEA-3 ammeter consists of three horizontal edgewise mechanisms, mounted one above the other in a single case and utilizing one single window. The two outstanding features characterizing this design are as follows:

1. The ease with which accurate comparisons can be made of the current in three different phases. For simultaneous readings they cannot be equalled as the slightest difference between the current in the different phases is indicated clearly.
2. The relatively small switchboard area compared with the space occupied by three standard full size horizontal edgewise instruments.

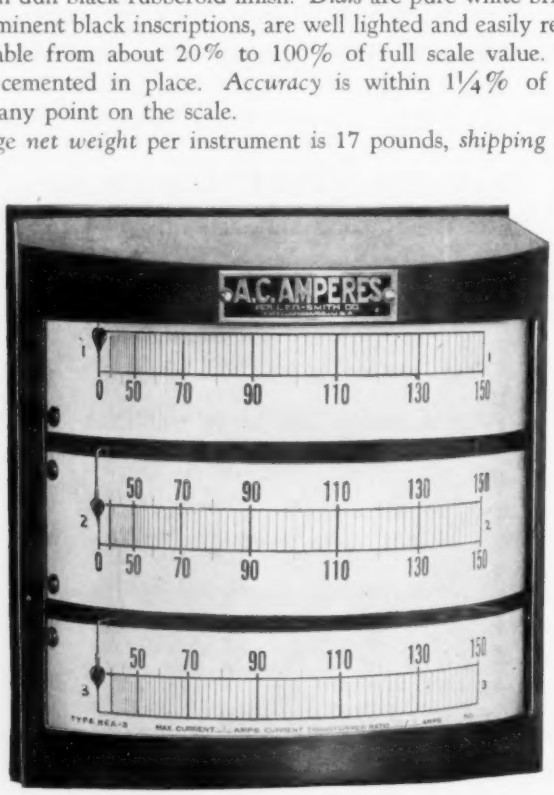


*Details* are as follows:

The *mechanisms* are of the standard electro-magnet type. *Damping* is obtained through a damping vane rotating in a die-cast chamber. The three mechanisms are *magnetically shielded* from each other, so that there is no mutual interference. The *individual scales* are 7⅛" long. *Base dimensions* are 8⅜" width and 9⅝" height and the case projects 6 29/32" from the board. *Connections* are in the form of three pairs of

rear studs firmly anchored to the base in bakelite bushings. For *mounting* the instrument it is necessary to drill only six holes in the switchboard, as the terminal studs act also as supporting studs. The case is finished in dull black rubberoid finish. *Dials* are pure white bristol board with prominent black inscriptions, are well lighted and easily read. *Scales* are readable from about 20% to 100% of full scale value. *The glass front* is cemented in place. *Accuracy* is within 1¼% of full scale value at any point on the scale.

Average *net weight* per instrument is 17 pounds, *shipping weight* 42 pounds.



**Lovibond's Tintometer for Measuring and Recording Colour**

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Lovibond's Colour System.

**The Tintometer Ltd., Colour Laboratory, Salisbury, Eng.**

**"STYLOGRAPH"**

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THE STYLOGRAPH CO. P. O., Coldwater, Rochester, N. Y.

Patent Applied for on Product, Process and Machines

# TYCOS Inner Seal Capsular Diaphragm

*R. E. Olsen, Taylor Instrument Companies**

THE capsular diaphragm or chamber being the expanding member of the temperature responsive system of most forms of compressed air operated temperature regulators, is an important unit. Upon its construction depends the life, sensitivity, and accuracy of this instrument.

As is generally known, the actuating force for the pilot air valve used in temperature regulators is derived from the movement of the capsular diaphragm. This diaphragm has joined to it a capillary of a length depending on the location of the instrument with reference to the

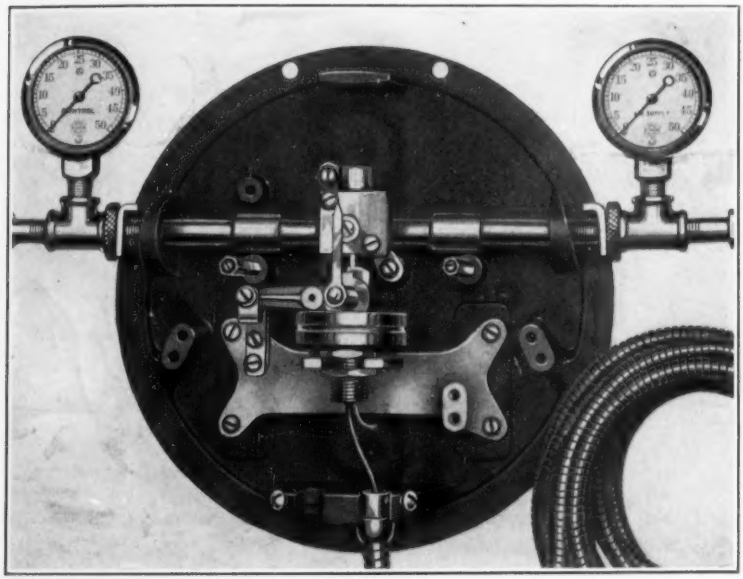

Fig. 1

apparatus under control. A bulb is attached to the other end of the capillary. These parts joined together form the tube system, which must be hermetically sealed to contain a liquid, vapor, or gas. A leak in any part, no matter how minute, causes the instrument to become inoperative. Fig. 1 shows the complete tube system assembled into a temperature regulator.

It has long been recognized that the development of leaks in the joints and seams of the capsular chamber has been the principal cause for tube system failures. With the object in view of eliminating this source of weakness, the Taylor Instrument Companies have for six years devoted its research facilities to the origination and development of a capsular

*Sales Engineering Department.

diaphragm of improved construction. The result of this work is a capsular diaphragm much the same in external appearance as the conventional type, but containing an inner envelope of comparatively thin metal. Details of construction are shown in the cross sectional view in Fig. 2.

In the conventional type of capsular diaphragm, no inner chamber or envelope is used, the pressure being exerted directly inside. This makes it necessary to subject the flexible members to high temperatures to facilitate soldering the joints, thereby changing their temper and flexibility. Furthermore, the movement of the relatively heavy flexible members

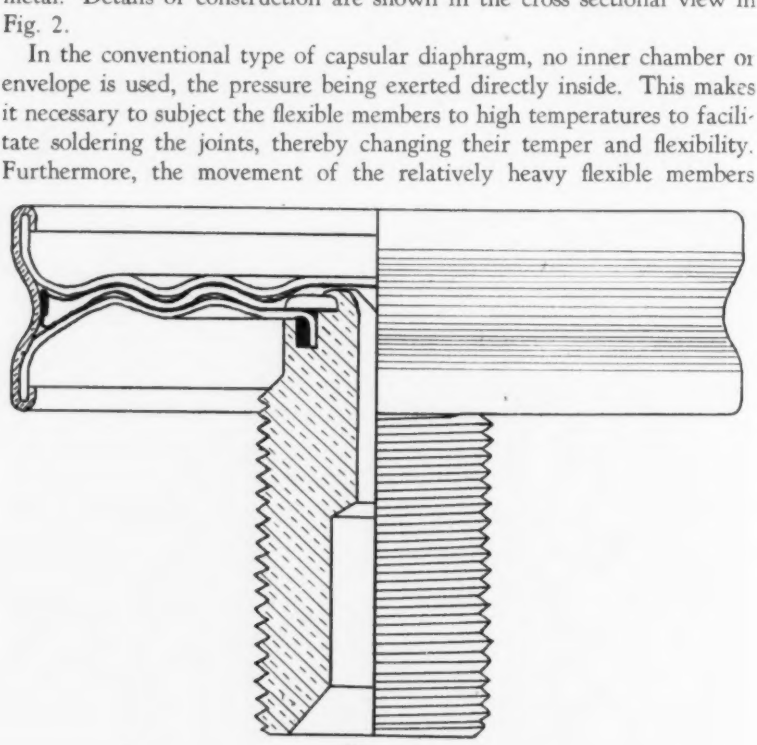

Fig. 2

when joined by solder ultimately causes the solder in the joint to crystallize, which results in leakage.

In the TYCOS Inner Seal Capsular Diaphragm, the outer chamber merely serves to limit the movement of the envelope. The envelope alone is internally subjected to the actuating pressure. In manufacture, no heat is applied to the outer chamber or flexible member, neither is solder used to make the assembly.

The points of design of the TYCOS Inner Seal Capsular Diaphragm may be summarized as follows:

Need for hermetically sealing soldered joints between heavy flexible members eliminated.

Actuating pressure applied only to inside of inner envelope, which is sealed by two joints as compared with three employed in usual construction.

Improved means of joining envelope to stud and of sealing the two members of the envelope at their outer edges.

# The New Polymeter

*(Sensitive Research Instrument Corp.)*

THE desire to create an instrument such as the Polymeter goes back over a number of years. It was designed with the idea of providing the research engineer with an instrument that would be simple, compact, accurate and rugged, and which would provide the constantly changing range needs that are encountered in development work.

The Polymeter covers all the ranges needed in direct current measurements. Its 13 ranges in current cover from 1 microampere (.000001 amp.) to 1 ampere and voltage from 50 microvolts (.00005 volts) to 1000 volts. Its resistance is 1000 ohms per volt and its 1000 volt range has 1,000,000 ohms as one unit in the instrument. It is almost a complete D.C. laboratory meter equipment in itself.

The Polymeter is built up to rigid specifications and close manufacturing limits. It contains a permanent magnet which is aged at least 18 months and the instrument is guaranteed to maintain its accuracy indefinitely.

Electrically the moving coil is protected by a replaceable fuse wire of our own development and we will replace a coil system that this fuse fails to protect, without charge.

Mechanically the coil system can be clamped for transit, and when clamped can be handled with just the average care.

The Polymeter is assembled in an American Walnut case, moulded Bakelite top. It has an 8 point selector switch, zero set, clamp button and binding posts.

In addition to covering 13 ranges in direct current by the use of vacuum, thermo-couples, measurements can be easily made of A.C. and Radio frequency currents. 14 ranges are obtainable from (.0004 amp.) to 1 ampere in easy overlapping steps.

The uses to which the Polymeter can be put are too numerous to mention as new ones are being discovered every day, as electrical research goes forward.

——— :: ———

# Direct Reading Brinell Impression Indicator

*(Pittsburgh Instrument and Machine Company)*

THIS attachment to the Brinell Testing Machine shows the diameter of ball impressions on a ground glass plate while the test load is applied. The operator can take his readings directly from the graduated

glass scale while the test piece is under pressure.

It has been proven that the diameter measurements of Brinell impressions are the same while the test load is applied and after it has been released.

The "direct reading" feature will be valuable in connection with production tests of large quantities of material; simple limit marks on the scale of the indicator will show the operator at a glance whether the material is according to specifications. No extra man is needed and no time is lost in measuring the diameter of impressions by the microscope.

To obtain a good shadow image of the impression it is necessary that the spot of the test piece where the indentation is to be made is nicely finished.

Fig. 1 shows a Power-operated Brinnell machine with the direct reading instrument attached.

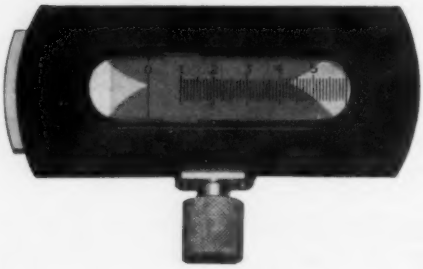

Figure shows how shadow lines give impression diameter while load is applied.

# New Standard S. G. Barnstead Water Still

*(Teschner-Myers Company)*

"NEW STANDARD" S. G. Barnstead Water Stills are of the vertical type, adaptable for use on wall brackets—and due to the upright position of condensers, they occupy considerably less space than other models.

The arrangement of condensers is such that a much smaller amount of water is used in the condensation—thus resulting in economy in

operation, the reason for this being that the cold water supplied to the apparatus is admitted at the hottest end of the condenser—thereby doing the greatest amount of condensing, while the water is still cool. This condensing water is also considerably hotter when same is delivered to the boiler than in the old type still. This is due to the method of con-

densation employed in the "New Standard" S. G. Barnstead Water Still, that makes it absolutely necessary for the hottest water in the condenser to be delivered to the boiler.

Baffle plates which prevent the apparatus from foaming over when hard water is used, are installed at two places—one under the cover, and the other where steam tube enters condenser.

"New Standard" S. G. Barnstead Water Stills are made in several stock sizes for heating by gas, electricity, or steam.

Gas stills of this type are far more economical in the amount of gas consumed—twenty percent more water per hour has been produced with the same amount of gas as was consumed in the old type apparatus.

Gas fumes escaping from the boiler do not discolor nor eat off the nickel of the upright condenser, which could not be avoided in the old type, on which it was necessary to hang the condenser over the escape for the gas fumes.

All "New Standard" condensers are equipped with castings to which the tubes are securely anchored.

**NEW INSTRUMENT INFORMATION FORM**

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- ☐ 1. The New Polymeter.
- ☐ 2. Tycos Inner Seal Capsular Diaphragm.
- ☐ 3. Direct Reading Brinell Impression Indicator.
- ☐ 4. Type H.E.A.-3 Ammeter for Three Phase Circuits.
- ☐ 5. New Standard S. G. Barnstead Water Stills.

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### Ammeter

The new type HEA-3 Ammeter of Roller-Smith Company, 233 Broadway, New York, N. Y. is covered by their Bulletin No. 450, Supplement No. 1.

### Balances

Various balances are illustrated in a recent bulletin of Julian H. Becker, Delft, Holland. This is printed in English.

### Dilatometer

The Stanley P. Rockwell Co., 66 Trumbull Street, Hartford, Conn., has just issued bulletin No. 2808 entitled "Importance of Time Control in Heat-Treatment Where Distortion is Detrimental."

### Electric Furnaces

Leaflet No. TA-20 on electric furnaces has recently been issued by the Harold E. Trent Company, 439 North Twelfth St., Philadelphia, Pa. This leaflet covers pot, trough, pit and direct heat type electric furnaces for lead, salt or cyanide for continuous service and temperatures up to 1700 deg. F.

### Experimenter

The December issue of the General Radio Experimenter issued by the General Radio Co., Cambridge, Mass., contains the following articles: How and Why the Talkies; New 600,000 Ohm Voltage Divider; Coil Data for Amateur Bands.

### Fuel Level Indicators

The Rochester Manufacturing Co., Inc., Rochester, New York, has issued literature on three types of fuel level indicators.

### Gas Service Journal

The November issue of the Gas Service Journal issued by Pittsburgh Equitable Meter Co., 400 Lexington Ave., Pittsburgh, Pa. contains the following: Collections with Good Will; Prize Winning Papers in Meter Reading Contest; Metering Gas at High Pressure; Depletion of Oil Well Computed on Basis of Income of Property; The World's largest Gas-Fired House Heating Job.

### Groundmeters

The Borden Electric Co., 480 Broad St., Newark, N. J. have issued Bulletin 70 entitled "The Groundology of Electrogrounds, Groundheads, Groundpoints and Groundometers.

### How Republic Iron & Steel Co. is heat treating more sheets and doing it better and cutting costs

is the title of a recent direct mailing of the Brown Instrument Company, Wayne & Roberts Avenues, Philadelphia, Pa.

### Improved Rosa Curve Tracer

A reprint from the Journal of the Optical Society of America and Review of Scientific Instruments on the above is being distributed by Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa.

### Instrument Investment News

Consolidated Ashcroft Hancock Company, Inc., 100 East 42 St., New York, have recently sent out the January issue of the Instrument Investment News containing the following articles: Instruments as fact finders; Reduction in Newsprint Price Necessitates Greater Manufacturing Efficiency; Instruments Safeguard Dyeing Advantages; Survey of 1928 Instrument Developments.

### Meters

Bulletin No. 4D has recently been issued by the Connersville Blower Co., Connersville, Ind., covering the various types of their meters. The bulletin is illustrated with representative types of these meters together with sample charts.

### Motor-Operated Controllers, Indicators, Contactors

The Automatic Temperature Control Company, Inc., 431 Cumberland St., Philadelphia, Pa., has issued a leaflet covering **motor-operated controllers, indicators, contactors, etc.**

### Oil Pressure Indicators

The Rochester Manufacturing Co., Inc., Rochester, New York, have recently issued a leaflet on their improved oil pressure indicators.

### Pioneer Instruments

The Pioneer Instrument Co., 754 Lexington Ave., Brooklyn, N. Y. have sent out a bulletin illustrating the various instruments and equipment manufactured by them.

### Positive Displacement Meter

Bulletin No. 40-B2 covering a new positive displacement meter has just been issued by the P. H. & F. M. Roots Co., Connersville, Ind.

### Price List—Baker's Chemicals

J. T. Baker Co., Phillipsburg, New Jersey, have just sent out their price list dated December 1, 1928.

### Recording Unit for Surface Condensers

Bulletin 827 issued by the Esterline-Angus Co., Indianapolis, Ind., covers an instrument which records vacuum, boiler priming and leakage of cooling water in surface condensers.

### Solarimeters and Pyrheliometers

P. J. Kipp & Zonen, Delft, Holland, have issued their bulletin Sol 27 covering instruments for measuring solar radiation.

### Tachometers

A bulletin on O-Z improved tachometers has been issued by O. Zernickaw Co., 15 Park Row, New York, N. Y. covering their hand tachometer.

### Tachometers

Pioneer Instrument Company, 754 Lexington Ave., Brooklyn, New York, have issued a leaflet on their aircraft tachometers.

### The Man on the Job is its Best Advocate

is the title of a recent direct mailing sent out by the Bakelite Corporation, 247 Park Ave., New York, N. Y.

### Use of Graphic Instruments by Central Stations

The Esterline-Angus Company, Indianapolis, Ind., have issued Bulletin 923 covering their instruments for the above applications.

### An Achievement in the Pyrometer Field

A recent leaflet published by the Thwing Instrument Company, 3339 Lancaster Ave., Philadelphia, Pa. covers their Model 28 Super pyrometer recorder.

### Flexible Shafts

The Stow Manufacturing Co., Inc., Binghamton, New York, have issued a catalogue covering Stow flexible shafts and motor driven tools.

### Bausch & Lomb Magazine

The December 1928—January 1929 issue of the Bausch & Lomb Magazine, published by the Bausch & Lomb Optical Company, Rochester, N. Y. has just been received.

### Oxy-Acetylene Tips

The December issue of Oxy-Acetylene Tips, issued by the Linde Air Products Co., New York, N. Y. contains an article entitled "Tests of Oxwelded Joints in Steel Pipe."

### Peroxide Calorimeter

Publication E-3 published by Burgess-Parr Company, Moline, Ill., covers the following: History, Principle of Operation, Chemicals used, Construction of Bomb, Construction of Jacket, and what the Calorimeter does.

### Oxygen Bomb Calorimeter

Burgess-Parr Company, Moline, Ill., has just issued Publication E-4 which gives complete information on their Oxygen Bomb Calorimeter.

### Miniature Voltmeters

List M12 published by the Park Royal Engineering Co., Ltd., Cumberland Ave., London, NW 10, England, covers their miniature precision portable voltmeters for direct current.

### Moving Iron Ammeters and Voltmeters

List M7 of the Park Royal Engineering Co., Ltd., Cumberland Ave., London, NW 10, England, describes their Moving iron ammeters and voltmeters.

### Vibrometer

The Vibration peciality Co., 1513 Winter Street, Philadelphia, Pa., describes their instrument for the measurement of vibrations.

### Moving Coil Ammeters and Voltmeters

The Park Royal Engineering Co., Ltd., Cumberland Ave., London, NW 10, England, have issued List 4 to cover their direct current long scale moving coil ammeters and voltmeters; and List 9 illustrates the same type of instruments for direct or alternating current.

### Gas Service Journal

The December issue of the Gas Service Journal published by the Pittsburgh Equitable Meter Co., 400 Lexington Ave., Pittsburgh, Pa., contains the following: Solving Fired Heaters; Natural Gas—A neglected Resource; The Equitable Gas Company; Gas Our Dust Problems; Reznor Warm Air Gas Flame becomes "The Ice Man."

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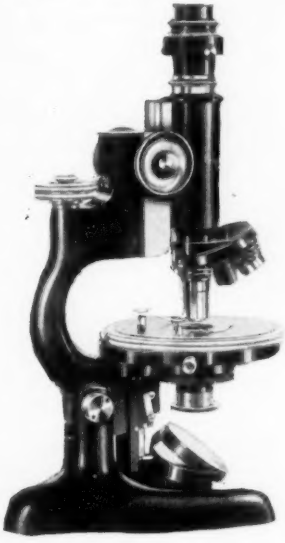
# The Chemists' Right-Hand Man



THE various types of work peculiar to a chemist demand a microscope possessing all of the characteristics necessary to perform such work. The chemist will find the New B & L Chemical Microscope able to answer all of his requirements.

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Taylor Instrument Companies

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Sensitive Research Instrument Corp.
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Bristol Company

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Taylor Instrument Companies

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**BALANCES**

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**CALORIMETERS**
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Brown Instrument Co.
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**THOMAS SPOONER,** INSTRUMENTS, Vol. 2, No. 1, January 1929, pp. 5-12, 5 figs.

The developments during the years 1927 and 1928 are considered. This article classifies the three types of magnetic measurements as follows: 1. Methods of determining the magnetic properties of materials; 2. Magnetic analysis: namely, magnetic tests which, when properly interpreted, give an indication of other physical properties; and 3. Magnetic surveying or prospecting: namely, the detection by magnetic means of the presence of ore bodies below the surface of the earth.

This installment considers the first classification. The February issue will cover divisions 2 and 3.

ELECTRICAL INSTRUMENT DEVELOPMENT DURING 1927-8.

**E. S. LINCOLN,** INSTRUMENTS, Vol. 2, No. 1, January 1929, pp. 13-17, 6 figs.

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AIRCRAFT INSTRUMENT DEVELOPMENTS IN 1928.

**BRADLEY JONES,** INSTRUMENTS, Vol. 2, No. 1, January 1929, pp. 19-21.

A brief review of the developments during 1928.

DEVELOPMENTS IN TEMPERATURE INDICATING, RECORDING AND CONTROL INSTRUMENTS DURING 1928.

**D. L. MATHIAS,** INSTRUMENTS, Vol. 2, No. 1, January 1929, pp. 23-26.

Review of the advances during 1928.

SEARCHING FOR INFORMATION ON INSTRUMENTS AND MEASUREMENTS.

**RICHARD RIMBACH and M. BERG RIMBACH,** INSTRUMENTS, Vol. 2, No. 1, January 1929, pp. 27-33.

A method for searching is suggested. Books containing information on the subject are listed as well as the periodicals. (Continued in the February issue.)

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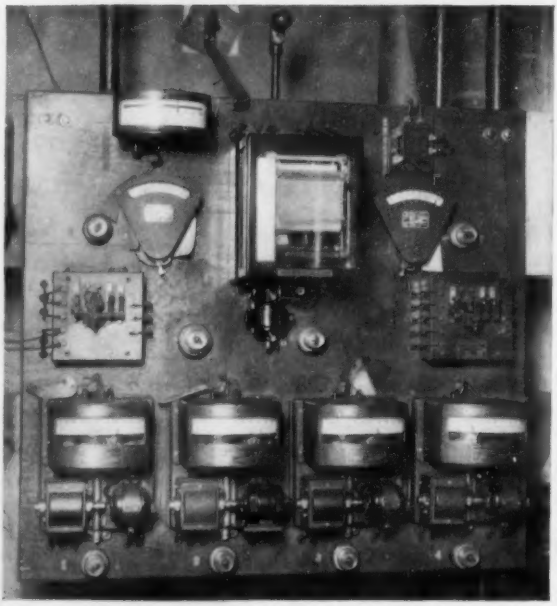

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